College of Engineering

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General Information

Instruction in professional engineering was first given at the University of Oklahoma in 1899 when a course in surveying was offered. The following year, 1900–01, the first two years of engineering were presented. In 1902–03 a curriculum in civil engineering was established, and a School of Mines was organized. At the same time, courses in electrical and mechanical engineering were listed. In 1904 the courses in engineering were organized as a School of Applied Science. In 1909 the School of Mines and the School of Applied Science were joined and reorganized as the College of Engineering. The first professional degrees were conferred in 1909.

The college has grown substantially since that time. It now offers degrees in 10 undergraduate engineering fields, as well as computer science and environmental science. The student body includes approximately 1,800 undergraduate students and 500 graduate students. Its facilities now fill eight major buildings with research facilities in portions of six other buildings.

In recent years, the College has been a major contributor to the philosophy of modern engineering education. It was one of the first to develop and adopt the “core” type engineering curricula now prevalent throughout the country. It was also one of the first to use the new approach to engineering laboratory work, wherein the student’s creativity is developed through the planning and carrying out of the experiment as an exercise in engineering analysis and design. Thus, the curricula in engineering are constantly being updated and modified to meet the needs of industry and future graduate work, increase the versatility of the student, and prolong the usefulness of the material taught.

The college is organized into schools and departments with the responsibility for administering the undergraduate and graduate programs of study, or
curricula, as listed in the later pages of this catalog. The professional subjects in these curricula are supported by courses from other colleges of the University. Upon satisfactory completion of one of the curricula, a student will be recommended for a degree, in most cases qualified by the name of the engineering field pursued.

School Directors
Farrokh Mistree, Ph.D., Director, School of Aerospace and Mechanical Engineering
Edgar A. O’Rear, Ph.D., Director, Bioengineering Program
Lance L. Lobban, Ph.D., Director, School of Chemical, Biological and Materials Engineering
Robert C. Knox, Ph.D., Director, School of Civil Engineering and Environmental Science
Sridhar Radhakrishnan, Ph.D., Director, School of Computer Science
James J. Sluss, Jr., Ph.D., Director, School of Electrical and Computer Engineering
Michael Santos, Ph.D., Chair, Engineering Physics Program
Randa L. Shehab, Ph.D., Director, School of Industrial Engineering

Faculty
The University of Oklahoma will celebrate its centennial of engineering education in the 2009-10 academic year. As the College of Engineering completes its first hundred years and looks forward to the next, the faculty is dedicated to excellence in carrying out the University mission of teaching, research and service. The faculty are drawn from many of the nation’s leading universities, including University of California, Georgia Tech, MIT, Rice, and Yale, to name a few. Over one in four faculty members in the college hold an endowed chair or professorship, and one in five hold Presidential Professorships. Four hold University of Oklahoma David Ross Boyd Professorships and eight hold George Lynn Cross Research Professorships. Many of them are recognized as Fellows of national professional societies. In addition, several of the faculty members advise student organizations, including design teams that compete at the championship level in national and international competitions.

Facilities
The main College of Engineering complex is located on the northeast corner of the University’s Norman campus. The six-story Carson Engineering Center includes classrooms and laboratories for civil and environmental engineering and environmental science, computer engineering, electrical engineering, and industrial engineering. Felgar Hall houses laboratories and facilities for aerospace and mechanical engineering, the Engineering Library, Information Technology (IT), and the Williams Student Services Center (WSSC). Sarkeys Energy Center houses chemical engineering and the bioengineering program. Other buildings include the Engineering Laboratory Building, housing the School of Computer Science. The College is in the process of constructing two new buildings scheduled to open Fall 2009; Devon Energy Hall and the Exxon-Mobil Lawrence G. Rawl Engineering Practice Facility. The Stephenson Research and Technical Center, located on the Research Campus, houses additional offices and labs for the bioengineering program. Several other smaller buildings for research purposes complete one of the finest engineering education complexes in the Southwest.

The other laboratories of the college are well-equipped to demonstrate the principles of courses offered and are described in other sections of this catalog. Through these laboratories and the actual use of apparatus, instruments, and equipment a student is able to make practical applications of the theories and principles which he/she has learned in the classroom.

Students of the college are active in field work. In addition, laboratories and other facilities of the College are used by the students and faculty members not only in their regular work, but also for research and experiments which are of benefit to the industrial development of the state.

COMPUTING
The OU Network consists of a high-speed backbone with connections to faculty, staff, laboratory, and classroom computers. Wireless technology extends the network to cover the engineering buildings, outside areas, laboratories, and classrooms. For more detailed information, visit:
http://support.ou.edu

LAPTOP REQUIREMENT
Students with a major in the College of Engineering are required to have a laptop computer. The laptop technologies are used to enhance the learning experience and the value of College of Engineering graduates. Students should consult with faculty advisers, IT, or the Williams Student Services Center (WSSC) for additional information.

The College believes that the use of a computer should be second nature to all of our engineering students, and that they should begin to utilize this technology from the time they arrive as freshmen. Specifically, we believe that a laptop affords students the best mix of speed, size, and mobility. The computer will be used in many ways, in class, out of class, on weekends, at home, in the dorm, to do research, to do assignments, to access the Internet, etc. Some instructors will utilize computers more than others, and some may not require them in class at all. However, if an instructor does require a laptop in class, it is the student’s responsibility to have one.

Williams Student Services Center (WSSC)
Phone: (405) 325-4096
P. Simin Pulat, Associate Dean for Undergraduate Programs
Susy Calonkey, Assistant to the Associate Dean
Tiffany Smith, Student Leadership and External Relations Coordinator
Elizabeth Bowers-Cook, Director of Diversity and MEP
Theresa M. Marks, Director of Advising
Jansi Adams Jacobs, Assistant Director of Advising
Jeannine Desmarais, Senior Academic Counselor
Clint Hardesty, Academic Counselor
D’juana Blakely, Senior Staff Assistant
Molly Emery, Staff Assistant

The Williams Student Services Center (WSSC) staff helps current and prospective College of Engineering students meet career and academic goals through academic advising, student support services, leadership development, and other programs designed to recruit, retain, and graduate the best possible engineering students. Tutoring, mentoring, College of Engineering scholarships, diversity initiatives, and many college-wide events such as the College’s Career Fair, annual Open House, and Convocation are coordinated by WSSC staff. For more information, visit the WSSC in Felgar Hall, Room 112, www.coe.ou.edu/wssc, call (405) 325-4096, or e-mail us at coe.wssc@ou.edu.

Strategy for Academic Excellence
The goal of the faculty, staff, and advisers of the College of Engineering is to provide our students a transforming experience of learning, discovery, and innovation. Our vision is to produce graduates and knowledge sought first in tomorrow’s technology-driven world. This is being accomplished by attracting a talented and diverse college community and empowering them to transform quality of life through education, research and development.

Strategies to make this vision a reality include:
• Enhancing the undergraduate learning experience through excellence in teaching and mentoring, educational innovations, and creativity in the knowledge delivery process;
• Enhancing the graduate learning experience through improvements in curricula, experiential learning, research, and technological innovations;
• Recruiting and fostering an outstanding and diverse college community;
• Developing a nationally and internationally prominent and high-impact research program through enhanced partnership, strategic focus, interdisciplinary research, and scholarship.
Undergraduate Programs

SCHOOL OF AEROSPACE AND MECHANICAL ENGINEERING
- Bachelor of Science in Aerospace Engineering
- Bachelor of Science in Mechanical Engineering (pre-med elective option also available)
- Accelerated BS/MS in Aerospace Engineering
- Accelerated BS/MS in Mechanical Engineering

SCHOOL OF CHEMICAL, BIOLOGICAL, AND MATERIALS ENGINEERING
- Bachelor of Science in Chemical Engineering (biotechnology and pre-medical/biomedical engineering elective options also available)
- Accelerated BS/MS in Chemical Engineering
- Accelerated BS/MS in Chemical Engineering (Biotechnology)/Bioengineering
- Accelerated BS/MS in Chemical Engineering (pre-medical/biomedical engineering)/Bioengineering

SCHOOL OF CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE
- Bachelor of Science in Architectural Engineering
- Bachelor of Science in Civil Engineering
- Bachelor of Science in Environmental Engineering
- Bachelor of Science in Environmental Science
- Accelerated BS/MS in Architectural Engineering/Civil Engineering
- Accelerated BS/MS in Civil Engineering
- Accelerated BS/MS in Environmental Engineering
- Accelerated BS/MES in Environmental Science
- Minor in Environmental Science

SCHOOL OF COMPUTER SCIENCE
- Bachelor of Science in Computer Science
- Accelerated BS/MS in Computer Science
- Minor in Computer Science

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING
- Bachelor of Science in Computer Engineering
- Bachelor of Science in Electrical Engineering
- Accelerated BS/MS in Computer Engineering/Computer Science
- Accelerated BS/MS in Computer Engineering/Electrical and Computer Engineering
- Accelerated BS/MS in Electrical Engineering/Electrical and Computer Engineering

PROGRAM IN ENGINEERING PHYSICS
- Bachelor of Science in Engineering Physics (jointly administered by the Department of Physics in the College of Arts and Sciences and the College of Engineering)

SCHOOL OF INDUSTRIAL ENGINEERING
- Bachelor of Science in Industrial Engineering (information technology and pre-medical elective patterns also available)
- Accelerated BS/MS in Industrial Engineering
- Accelerated BS/MBA in Industrial Engineering/Business Administration
- Accelerated BS/MS in Information Technology

The following programs are accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET): Aerospace Engineering, Architectural Engineering, Chemical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Engineering Physics, Environmental Engineering, Industrial Engineering, and Mechanical Engineering. The Computer Science program is accredited by the Computing Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore MD 21202-4012; telephone: (410) 347-7700.

Admission to the College

Students must be admitted to the University of Oklahoma before they are accepted into the College of Engineering. Inquiries concerning admission to the University should be directed to: Office of Admissions, University of Oklahoma, 1000 Asp Avenue, Room 127, Norman, OK 73019-4076. (Please refer to the “Admissions, Enrollment, and Student Financial Services” section of the catalog for detailed information on admission to the University.) Students should carefully assess their potential to meet the college’s requirements before committing to attend the University of Oklahoma with a proposed major in engineering.

In order to be eligible for admission to the College of Engineering, applicants who are direct from high school must be admitted to OU and have earned 24 semester credit hours with a combined retention grade point average of 2.00 or higher. Non-residents of Oklahoma transferring to the University of Oklahoma, College of Engineering must have a retention GPA of 3.00, regardless of the institution from which they are transferring.

The Schools of Aerospace and Mechanical Engineering and Electrical and Computer Engineering have requisite course and additional grade point average requirements. For details see the individual school sections of this catalog.

Scholastic, Transfer and Special Regulations

The College of Engineering subscribes to the grading practices and policies in effect at the University of Oklahoma. Special considerations after admission are:

a. Students may check transfer equivalencies on the transfer equivalency tables at http://www.ou.edu/admrec/tetables.htm.

b. Students should visit the Williams Student Services Center (WSSC), 112 Felgar Hall, to determine exactly how their transfer credits apply to their College of Engineering degree program.

c. Pass/No Pass course enrollments may not be used to satisfy College of Engineering course requirements. (Note: S/U graded courses are not the same as Pass/No Pass. S grades are permitted to count toward course requirements.)

d. Academic credit from any division of the University of Oklahoma — Norman campus, OU Health Sciences Center, OU-Tulsa, or Continuing Education — is considered resident credit at the University of Oklahoma. Grades and hours earned at any of these divisions are included in the OU retention and cumulative grade point averages for purposes of admission or readmission to the University, and to the individual colleges within the University. (See also Residence Requirements under Graduation Requirements.)

e. A minimum grade of C is required for each course offered toward the degree.

f. The Schools of Aerospace and Mechanical Engineering and Electrical and Computer Engineering have additional grade point average and course requirements. For details, see those sections in this chapter of the catalog. Likewise, there are additional grade point average requirements for those students in accelerated degree programs. Please consult the the graduate program liaison in any specific engineering program for details.

ACADEMIC PERFORMANCE

A student must maintain at least a 2.00 grade point average (GPA) in order to be in good standing in the College. Any student who has a combined or OU retention grade point average that falls below 2.00 is on academic performance contract. Further, any student who has a major or curriculum OU and/or combined retention grade point average that falls below a 2.00 is on
academic performance contract. Students on contract may be denied enrollment privileges in upper-division major courses and are not allowed to pre-enroll. The OU retention GPA must be at least a 2.00 or greater after one semester or the student will be dismissed (stopped out), from the College of Engineering.

Students are also on contract if they take a required curricular course twice and do not successfully complete it the second time (with a minimum grade of C). These students must take the course the next time it is offered and must complete it with a minimum C grade. Otherwise they will be permanently dismissed (stopped out), by the College of Engineering.

*Dismissal from the College of Engineering does not necessarily include suspension from the University. Suspension from the University of Oklahoma is administered in accordance with established University policies outlined in the “Standards of Scholarship” section of this catalog. Any student who is on academic contract will not be allowed to initiate enrollment into a semester after classes begin.

If, at any time during a semester, the scholastic standing in any class of a student on contract is deemed unsatisfactory (for instance, if the prerequisites are not met), the College office will recommend to the Office of Enrollment Services that the student be dropped from the course.

A student on academic contract in the College or on academic probation with the University may not hold office in any student organization in the College of Engineering or in any University sponsored or recognized organization or activity.

ENROLLMENT STOPS AND READMISSION
Students on academic performance contract who fail to bring their OU and combined GPA to a 2.0 after one semester will have an enrollment stop placed by the College of Engineering. A student who has taken a curricular course twice and not completed it for curricular credit (for instance, has made a D, F, I, U, W, W, or AU) is on contract. (Note: If the first attempt is a W, it does not count against the student; a subsequent W for the same course does count against the student.) If the student does not successfully (grade of C or better) complete the course the third time it is taken, the student is stopped from the college. A student who has been dismissed (stopped out) from the College of Engineering may be eligible for enrollment in another college under the University retention policy. To continue at the University of Oklahoma, the student will need to make an appointment with the Center for Student Advancement, 311 Old Science Hall, or call 325-2574. However, even if the student is able to continue at the University, further enrollment in College of Engineering courses is not allowed.

A student who has been dismissed (stopped out) from the College of Engineering is unlikely to be readmitted to the College.

UNIVERSITY PROBATION AND SUSPENSION
Students should consult the “Admissions, Enrollment and Student Financial Services” section of this catalog for the policy concerning University probation and suspension.

HONOR ROLL
To be eligible for the College of Engineering Dean’s Honor Roll, a full-time undergraduate student must earn at least 12 or more hours and attain a grade point average of 3.00 or higher during a regular fall or spring semester. Part-time students may qualify for the honor roll by earning at least six but less than 12 hours and attaining a grade point average of 3.00 or higher, provided they have no W’s for that semester. There is no college honor roll during the summer session or during inter sessions, and hours and grades earned during these sessions are not included in any way in determining eligibility for inclusion on regular semester honor rolls.

CONDUCT OF ENGINEERING COURSES
A student is responsible for the prerequisite and the content of any course in which he or she is officially enrolled. The establishment of specific policy concerning class attendance requirements, as well as announced and unannounced examinations, is the responsibility of the individual instructor. When absences seriously affect a student’s classwork, the instructor may report this fact to the Office of Admissions and Records and the information will be directed to the student’s college dean.

The College of Engineering requires comprehensive examinations to be given during the regularly scheduled examination periods in all undergraduate courses excluding directed readings, pure laboratory courses and project type design courses and seminars. No faculty member is authorized to depart from this regulation or from the published examination schedule for a class or an individual without prior approval. Special early examinations given to individual students or groups of students as substitutes for final examinations are prohibited. A student will not be expected to take more than two examinations in one day.

ACADEMIC APPEALS
The College of Engineering has established an Academic Appeals Panel to hear grade appeals and academic misconduct cases. To obtain the procedures to be followed, a student should contact the Dean’s office in 107 Carson Engineering Center, and refer to Title 14 of the Student Code.

OFFICIAL NOTICES
Students should watch the bulletin board in the Williams Student Services Center, and in the west entry of Carson Engineering Center. Additional information is available on the Williams Student Services Center home page (http://www.coe.ou.edu/wssc/) and/or in the respective school offices within the College.

Enrollment Information
CREDIT HOUR LOAD
Students normally enroll in 12-19 hours of work during a regular 16-week semester. Enrollment in more than the maximum credits allowed for a specific term is permitted only with the approval of the Academic Dean. Students who exceed the maximum hours will depend primarily on the student’s academic record and his/her demonstrated ability to carry increased loads. State Regents limit the overload to a number of semester hours 50 percent greater than the number of weeks in the applicable term. Limits on the number of credit hours a student may enroll in each semester without special permission are as follows:

- FALL/SPRING — 19 hours for undergraduates
- SUMMER, 8-week sessions — 9 hours for undergraduates
- SUMMER, 4-week sessions — 5 hours maximum for either of the four-week mini-sessions

(Please Note: No student will be permitted to exceed 24 credit hours for fall/spring, 12 credit hours for summer, and five credit hours for intersession.)

ADVISEMENT
All students in the College of Engineering are assigned a faculty adviser in their major field, and a college (WSSC) adviser who ultimately clears the student for graduation. If a student has not yet selected a specific engineering field, he/she will see an adviser in the Williams Student Services Center. Students risk delaying their graduation if they do not make a timely selection of a major. Students must consult with and obtain the signature of the faculty adviser in order to be cleared for enrollment. The College of Engineering does not permit “self-advising.” All engineering transfer students must meet with a college (WSSC) adviser before enrollment into their first semester at OU.

ENROLLMENT IN UPPER-DIVISION COURSES
Enrollment in upper-division College of Engineering courses, except any courses specifically exempted in the General Catalog or Class Schedule, is restricted to students who are admitted to the College of Engineering and in some cases to those admitted to a specific degree program, have completed the necessary grade and course prerequisites, and are advised into the classes by their engineering faculty or staff adviser. Qualified students from outside the College of Engineering are welcome in advanced courses if they have completed the necessary grade and course prerequisites, and are encouraged to explore specific interests with the schools and instructors involved. Approval must be obtained from the professor teaching the course and the Director of Advising in the Williams Student Services Center (WSSC), 112 Felgar Hall.
ENROLLMENT LIMITATIONS
1. Pass/No Pass course enrollments may not be used to satisfy College of Engineering course requirements.
2. Students may not proceed in their major courses until they have achieved a minimum grade of C in all prerequisites.
3. Students may take a course in their curriculum only three times (this includes I, AU, W, AW, D, F). If the course is taken unsuccessfully three times and is a course required in all curricula in the College of Engineering, the student will receive a permanent Enrollment Stop from the College of Engineering. **Note:** The first W is not counted in the “three attempts” rule. If the course is taken unsuccessfully three times and is required only in the major, the possibility of a student continuing in the College of Engineering in a different major will be determined on an individual basis.
4. When courses are repeated, the last time a student takes a course is the grade of record.

Basic Degree Requirements
The basic requirements listed below may be completed in four years. Students with deficiencies in their English, mathematics, or basic science skills may require additional coursework to reach the necessary level of college preparation or what is often referred to as “being curriculum ready.” These students should plan on additional semesters of study.

All undergraduate students majoring in a professional engineering program of the College of Engineering must satisfactorily complete the curriculum outlined below. For more complete information concerning the requirements for each degree, see the curriculum listed under each school of specialization. Curriculum check sheets are also available in the Williams Student Services Center (WSSC), 112 Felgar Hall, and on the Web at checksheets.ou.edu/engindx.htm.

Students with engineering undecided majors are guided and encouraged to decide on a specific engineering major prior to the completion of 24 semester hours.

CORE PROGRAM
All engineering curricula within the College of Engineering contain a “core” program of coursework. The core program consists of courses in mathematics, basic science and engineering science. Placement in mathematics and chemistry courses is based on high school preparation and performance on placement examinations. A student may enter a course sequence (such as Math 1823, 2423, 2433 and 2443) at a level appropriate for his/her ability. However, college credit must still be obtained for each of the courses listed below. A student relieved from any course must gain college credit by advanced standing examination or by substituting a course with school and adviser approval. The following courses constitute the “core” program.

**Mathematics**
- 1823, Calculus and Analytic Geometry I
- 2423, Calculus and Analytic Geometry II
- 2433, Calculus and Analytic Geometry III
- 2443, Calculus and Analytic Geometry IV

**Basic Science**
- Chemistry 1315, General Chemistry
- Physics 2514, General Physics for Engineering and Science Majors
- Physics 2524, General Physics for Engineering and Science Majors

**Engineering Sciences—Required:**
- 1411, Freshman Engineering Experience, or 3511, Engineering Orientation Experience for Transfer Students
- 2002, Professional Development
- Computing: Structured Programming Language. (The College of Engineering believes that all engineering students should have a background in structured programming. Each school will determine the course(s) in structured programming language(s) that best fit the needs of its students.)

**GENERAL EDUCATION REQUIREMENTS**
All College of Engineering students who obtained their first college credit during Fall 1990 or later are required to satisfy the University-wide General Education course requirements. Courses must be chosen from five areas. Students who have completed a non-technical Associates degree from within the Oklahoma State System of Higher Education, or an accredited bachelor’s degree from any institution may have select courses or exemptions from certain of the following General Education Requirements. Students in the College of Engineering should check with an adviser in the Williams Student Services Center (WSSC), 112 Felgar Hall for further information.

I. Symbolic and Oral Communication — this area requires six hours of grammar and composition, foreign language, and three hours of mathematics. Current degree requirements in all College of Engineering curricula satisfy all general education English and mathematics requirements. The foreign language requirement can be satisfied by either two years of the same foreign language in high school or two semesters at the college level.

II. Natural Science — requires two courses totaling seven hours in two different sciences; at least one course must include a laboratory component. Engineering students satisfy this requirement with the physics and chemistry courses currently required.

III. and IV. Humanities/Social Sciences — requires American Federal Government and U.S. History, plus additional four courses, three hours each, which must be chosen, one each, from four areas: (1) Social Sciences; (2) Understanding Artistic Forms; (3) Western Civilization and Culture; and (4) Non-Western Culture. General education requirements state that one of these four courses must be taken at the upper-division level and outside the student’s major. Since only a small number of upper-division courses are approved by the General Education Committee for social science and artistic forms, the College of Engineering recommends students take their upper-division courses in the Western and Non-Western Culture areas.

V. Senior Capstone Course — this requirement will be satisfied by a senior design course designated as a capstone course in the student’s major. The capstone course must be taken at OU.

Students whose first college work was prior to Fall 1990 or who have transfer coursework completed prior to Fall 1990, do not have a foreign language requirement and must meet an alternative 12-hour Humanities/Social Sciences requirement. Information on the alternative requirement is available in the Williams Student Services Center (WSSC).

PETITIONS
**General Education** — Any departure from the General Education rules and regulations must be petitioned to the Provost’s Advisory Committee on General Education. This petition must be submitted through the Williams Student Services Center (WSSC).
College of Engineering — Any departure by a student from the curriculum requirements, other than General Education, and scholastic rules must be approved by a petition in the school of the student’s major, and must not conflict with existing University regulations. A student submitting a petition must obtain the written recommendation of his/her adviser and submit it to his/her major school for faculty action. Petitions should be submitted in a timely manner since time restrictions can preclude their consideration. After a decision of petitions, they are forwarded to Williams Student Services Center (WSSC) to be placed in the student’s permanent record in the College.

Second Bachelor’s Degree
A student who has completed the requirements for the bachelor’s degree at OU may also receive a second bachelor’s degree at OU upon the completion of the curriculum prescribed for the second degree, provided that the work completed includes at least 30 additional hours of upper-division engineering; applied science and elective courses appropriate to the field of the second degree at OU. These courses must be over and above the hours completed for the first degree. All admission, retention and graduation requirements listed previously hold for the second degree. The curriculum to be followed will be decided jointly with the student, the faculty adviser, and the Williams Student Services Center (WSSC), in accordance with current University and College policy.

Minors
Within the College of Engineering the School of Computer Science offers a minor in Computer Science and the School of Civil Engineering and Environmental Science offers a minor in Environmental Science. In addition, engineering students may complete minors in other Colleges at OU — such as math, chemistry, philosophy, etc. — and these will be posted on the transcript after graduation. A new minor has been established specifically for engineering students in the Price College of Business; the Entrepreneurship Minor.

For details of the minors available from within the College, students should check with the Williams Student Services Center (WSSC), 112 Felgar Hall. For other minors, students should check with the college which offers the minor for specific requirements and declaration of the minor.

Students who have been stopped out of the College of Engineering for academic reasons are not allowed to enroll in engineering courses while in stop out status. For this reason, students dismissed (stopped out) of the College of Engineering for academic reasons will be ineligible to pursue the Computer Science or Environmental Science minors.

BS/MS Accelerated Degree
Several engineering programs offer accelerated BS/MS degrees.

- Bachelor of Science in Aerospace Engineering and Master of Science (in Aerospace Engineering)
- Bachelor of Science in Architectural Engineering and Master of Science (Civil Engineering)
- Bachelor of Science in Chemical Engineering and Master of Science (in Bioengineering)
- Bachelor of Science in Chemical Engineering and Master of Science (in Bioengineering)
- Bachelor of Science in Civil Engineering and Master of Science (in Chemical Engineering)
- Bachelor of Science in Computer Engineering and Master of Science (in Computer Science)
- Bachelor of Science in Computer Engineering and Master of Science (in Computer Science)
- Bachelor of Science in Electrical Engineering and Master of Science (in Electrical and Computer Engineering)
- Bachelor of Science in Environmental Engineering and Master of Science in Environmental Engineering
- Bachelor of Science in Environmental Science and Master of Environmental Science
- Bachelor of Science in Industrial Engineering (Standard Option) and Master of Science (in Industrial Engineering)
- Bachelor of Science in Industrial Engineering (Standard Option) and Master of Business Administration
- Bachelor of Science in Industrial Engineering (Information Technology Option) and Master of Science (in Industrial Engineering)
- Bachelor of Science in Mechanical Engineering (Standard Option) and Master of Science (in Mechanical Engineering)

These degrees are designed to be completed in five years for the student who is curriculum ready upon beginning the freshman year. Several of the senior level courses are taken at the graduate level and are counted in both degrees. For further information, see details under the information about the schools and their degree program or contact Williams Student Services Center (WSSC) at (405) 325-4096.

Graduation Requirements
The College of Engineering is organized into departments and schools. The degree of Bachelor of Science qualified by the name of the engineering field pursued is conferred upon graduates of the College. The student must satisfy the following requirements:

1. Curricular Courses: complete all prescribed curricular courses or equivalent courses as approved by the faculty with a minimum grade of C in each course.
2. Two-year College Transfer Credits: a minimum of 60 semester hours must be earned in a senior college or four-year school for a baccalaureate degree.
3. Degree Requirements: fulfill all requirements listed on the degree sheet. Although the Williams Student Services Center (WSSC), and school office check each student’s records, the responsibility for meeting graduation requirements lies with the student, and not with the adviser, the school or the dean.
4. Be in good academic standing with the College and the University.
5. Make application for the degree by the deadline date for the semester in which the student plans to graduate. The deadline date will be posted on the Williams Student Services Center (WSSC) bulletin board, 112 Felgar Hall.
6. To insure that the above conditions will be met, the student should request a degree check by completing the Graduation Check form in the Williams Student Services Center (WSSC). This action should be taken during the semester before the student expects to graduate. The student can access his/her degree audit at any time online through Degree Navigator (degree.ou.edu), which can be used as a tentative semester-by-semester graduation check.
7. Residence Requirements — to be recommended for a degree, a candidate must have:
   a. spent two semesters or the equivalent in residence, with at least one semester enrolled as a College of Engineering student;
   b. completed at OU 36 of the hours listed in the junior and senior years on their curriculum checksheet, 24 of these 36 hours must be in the major field;
   c. fulfilled the grade and grade point requirements of the College and School;

NOTE: Academic credit from any division of the University of Oklahoma — Norman campus, OU Health Sciences Center, OU-Tulsa, or Continuing Education — is considered resident credit at the University of Oklahoma. Grades and hours earned at any of these divisions are included in the OU retention and cumulative grade point averages for purposes of determining completion of degree requirements.

8. Three categories of degrees are offered in the College of Engineering as follows:
   a. Bachelor of Science: the College of Engineering is organized into departments and schools. The degree Bachelor of Science qualified by the name of the engineering field pursued is conferred upon graduates of the College.
   b. Distinction: the College may recommend that the degree With Distinction be conferred on students who have a combined cumulative
grade point average of 3.40 and With Special Distinction on students who have a combined cumulative grade point average of 3.70.

c. Honors: the Honors College may recommend the degree cum Laude, Magna cum Laude or Summa cum Laude. Special requirements, in addition to the regular requirements for graduation, are approved by the Honors College.

Degrees are formally conferred at spring commencement and convocation exercises. However, degrees are also awarded in absentia at the end of each fall semester and summer session. All diplomas are mailed to students following the official graduation date. The degree and date of the diploma are entered on the student’s permanent academic record. The date of graduation is the last day of the semester or summer session in which all requirements for the degree are completed. When a student completes all requirements for a degree, other than at the close of a semester or summer session, the Office of Academic Records, upon request, will issue a certified statement that the student is eligible for the degree as of the date when the requirements for the degree were completed.

GRADE AVERAGE REQUIREMENTS
For information on the State Regents Repeat/Reprieve Forgiveness Policy and Retention/Cumulative GPAs, see the “Academic Standards” section of this catalog.

In order to graduate, a student must have:
1. A minimum grade of C in each course required in the curriculum.
2. Both an OU retention and a combined retention grade point average of 2.00 or higher.
3. A 2.00 minimum combined retention average for all attempted courses presented to satisfy curriculum requirements. Curriculum requirements include each and every course on the selected degree requirement sheet.
4. A 2.00 minimum OU retention average for all courses attempted at the University of Oklahoma used to satisfy curriculum requirements.
5. A 2.00 minimum OU and combined retention average in all courses taken in the major field. Major field is defined by the degree field selected.

For purposes of graduation and retention, these grade point averages may be affected by academic forgiveness policies. Students should consult the “Admissions, Enrollment and Student Financial Services” section of this catalog for more information.

Students not meeting the grade average requirements explained above have grade point deficiencies, and they must undertake efforts to raise their grade point average. This must be done with the approval of the Williams Student Services Center and the faculty adviser.

TIME LIMITATIONS ON COURSEWORK
A student may elect to graduate under the requirements for an undergraduate degree plan in effect at the time of his or her first enrollment in the state system, provided that he or she completes the work for a degree within a maximum of six years, which is reflected in the degree check. If the work for a degree covers a period longer than that specified by the College, the College will determine the degree plan to be in effect for that student’s graduation.

A student whose initial enrollment in the state system is during the summer session will be subject to the University of Oklahoma catalog in effect for the year following that summer.

Credit in the student’s major field or area of concentration which is more than 10 years old may not be applied toward a bachelor’s degree unless it is validated by the major department, or by the departments in the student’s area of concentration. (The term “area of concentration” is included in addition to “major field” to allow for those cases in which the equivalent of a major may be earned by a combination of work in several departments.)

Other Information

CO-OP PROGRAM
The Co-op Program offers a work-study experience which combines a sequence of academic study and engineering employment in industry or government. Participating in the Co-op Program allows the engineering student to gain first-hand experience in the application of academic studies to engineering problems. The student makes personal contact with practicing engineers which may be useful in furthering long-term career goals. The co-op student receives compensation during work periods, which may assist in financing his or her education, and earns academic credit for the co-op work, of which up to three credit hours may be applied toward a degree program.

Participation in the Co-op Program is optional and open to students enrolled full time in a degree program administered by the College of Engineering. Students who wish to participate in the Co-op Program must have completed all of the requirements of the first year of their degree program with a minimum 2.50 GPA. Students must also have the approval of the Director of the school of their major. Employment in a Co-op position requires the approval of the participating company. Interested students should apply as soon as possible during their first three semesters on campus.

The time required to complete an engineering degree program as a Co-op student will be longer than the usual eight semester program. (Caution: Major courses in several CoE degree programs are sequential and offered only one time per year.) For further information and application forms contact the Co-op Coordinator at Career Services, Suite 323 Oklahoma Memorial Union, (405) 325-1974.

ENGINEERING SOCIETIES AND CLUBS
It is important that the student have opportunities to learn leadership skills, organizational skills and become acquainted with people of the industry and meet as many practicing engineers as possible. The best and easiest way of doing this is to become an active member of a student organization which is affiliated with one of the national engineering societies.

Departmental clubs and societies, arranged in order of establishment, are given below:
- Engineers’ Club, 1910;
- Institute of Electrical and Electronic Engineers, 1912;
- American Society of Civil Engineers, 1912;
- American Society of Mechanical Engineers, 1914;
- Loyal Knights of Old Trusty, 1920;
- Society of Petroleum Engineers, 1933;
- American Institute of Chemical Engineers, 1935;
- Society of Automotive Engineers, 1938;
- Society of Women Engineers, 1941;
- American Institute of Aeronautics and Astronautics, 1942;
- Society of Physics, 1948;
- Institute of Industrial Engineers, 1950;
- American Indian Science and Engineering Society, 1977;
- National Society of Black Engineers, 1979;
- Association for Computing Machinery, late 1970s;
- Triangle Fraternity for Scientist, Engineers and Architecture, 1983;
- Society of Manufacturing Engineers, 1984;
- Society of Hispanic Professional Engineers, 1985;
- Institute for Operations Research and the Management Scientists, 1990;
- Environmental Science Student Association, 1992;
- Human Factors and Ergonomics Society, 1993;
- Alpha Sigma Kappa, 1997;
- OU Robotics Club, 1999;
- Engineering Leadership Roundtable, 2001;
- Deans Leadership Council, 2002;
- Biomedical Engineering Society, 2002;
- Game Developer’s Association, 2004;
- Engineers Without Borders, 2005;
- Architectural Engineering Institute, 2007;

The Engineers’ Club at the University of Oklahoma was founded in 1910 and has grown to be one of the largest student organizations on campus. Its main function is to provide a social network to promote better fellowship among students, faculty, alumni, and professional engineers and to increase the future engineers’ knowledge of engineering in all of its phases — communication, organization, and participation, as well as training in technical matters.
The main events of the club include an annual welcome-back-to-school and new students Fall Festival/New Engineers Welcome, Engineering Career Fair, University of Oklahoma Homecoming competitions, College of Engineering Open House for Oklahoma high school students, Winter Ball, many activities and festivities throughout National Engineer’s Week, and a Spring Leadership Retreat.

The American Indian Science and Engineering Society established in 1977 was the first organization of its kind in the nation. Graduates of this first chapter went on to assist in the establishment of the national chapter of AISES. The Society of Women Engineers or SWE Chapter in the College of Engineering is part of a national organization for women in engineering and OU’s chapter was again one of the first established in the nation. National student chapters of the Society of Black Engineers and the Society of Hispanic Professional Engineers round out the outstanding student organizations with goals to assist in the recruitment and retention of a diverse engineering and science student body at the University of Oklahoma.

HONOR SOCIETIES AND ORGANIZATIONS

Students in the College of Engineering at OU have numerous opportunities for leadership, honor, and recognition through university-wide honor societies and organizations such as: Alpha Lambda Delta, Phi Eta Sigma, the “Top Ten” programs, Golden Key, Tassels, Big Man on Campus/Big Woman on Campus, Omicron Delta Kappa, Mortar Board, Letzeiser Awards, and Order of the Omega.

Tau Beta Pi, honorary society in engineering, was founded at Lehigh University in June, 1885. Its purpose is to offer students of technical schools of America membership in an honorary association. It is not wholly a professional society since students who are qualified in any branch of engineering may become members. The annual election to the society, which is based upon scholarship, integrity, breadth of interest (both inside and outside of engineering), adaptability and unselfish activity, is limited to the upper one-fifth of the senior class and to the students who have grade averages within the upper one-eighth of the junior class. The government of the organization in each chapter is under the direction of the elected student officers and an advisory board consisting of four faculty members of Tau Beta Pi. Membership in Tau Beta Pi is one of the highest scholastic honors that an undergraduate engineering student can receive. The Oklahoma charter was granted in 1926.

In addition to the above honorary societies open to selected students of all College of Engineering schools, chapters of the following university honorary fraternities are active at the University of Oklahoma: Sigma Gamma Tau, 1927, national honor society of aerospace engineering; Pi Tau Sigma, 1939, national honor society of mechanical engineering; Eta Kappa Nu, 1942, national honor society of electrical engineering; Pi Epsilon Tau, 1947, national honor society of petroleum engineering; Sigma Gamma Epsilon, 1916, national honor society of geology; Alpha Chi Sigma, 1919, national honor society of chemistry; Pi Mu Epsilon, 1929, national honor society of mathematics; Sigma Pi Sigma, 1930, national honor society of physics; Alpha Pi Mu, 1968, national honor society of industrial engineering; Tau Sigma Delta, 1968, national honor society of architecture; and Chi Epsilon, 1983, national honor society of civil engineering.

INTERNSHIPS

The College of Engineering encourages all students to spend at least one summer as an intern either with College faculty assisting with research or with industry. Both the Williams Student Services Center (WSSC) and the OU Career Services office work to facilitate this process.

MULTICULTURAL ENGINEERING PROGRAM

The University of Oklahoma Multicultural Engineering Program (MEP) is designed for the recruitment and retention of students who contribute to the diversity of the College of Engineering. Academic and professional support include a freshmen orientation course, tutoring, career and employment assistance, and a scholarship program. Scholarships are available on a competitive basis with need and academic achievement used as selection criteria. Information may be obtained by contacting: Multicultural Engineering Program, 865 Asp Avenue, 112 Felgar Hall, Norman, OK 73019-1053, (405) 325-4096.

STUDY ABROAD PROGRAMS

The College of Engineering encourages students to participate in the excellent Study Abroad programs sponsored by the University of Oklahoma. There is one program specifically for College of Engineering students, which takes place during the summer: Clermont-Ferrand, France for General Education approved Social Science and Western Civilization course. These courses are taught in English.

In addition, many students choose to spend a semester or year studying engineering and/or other subjects in one of the over 60 countries/171 universities with which the University of Oklahoma has reciprocal agreements. For further information, see: www.ou.edu/ea/home.html.

Scholarships and Financial Aid

Students with majors in the College of Engineering are eligible for merit-based scholarships administered through the College of Engineering Dean’s Office, the individual schools within the College of Engineering, or the OU and National Scholars Offices. The scholarships are listed in the publication, A Guide to Scholarships & Financial Aid, which is available from the Office of Prospective Student Services, (405) 325-2151, or 1-800-234-6868, or online through the OU Financial Aid Services Web site at http://financialaid.ou.edu.

Incoming freshmen and new transfer students are encouraged to apply through the university’s online scholarship application process, and the school of your major within the College of Engineering. Please refer to application forms for scholarship deadlines. Deadlines must be met for proper consideration for the academic year. Incoming freshmen should fill out only the OU universal freshman admissions and scholarship all-in-one (online) application form to be considered for any scholarship the College of Engineering Dean’s Office has available through the Distinguished Scholars Program.

Transfer students should fill out the OU universal transfer admissions and scholarship all-in-one (online) application form to be considered in the centralized application process for any scholarship the College of Engineering Dean’s Office has available for transfer students.

Sophomores, juniors and seniors should apply through the school of their major to be considered for any scholarship the Dean’s Office has available. Students entering the University should also explore scholarships offered by their hometown, civil service, fraternal, and industrial organizations. Contact the Office of Financial Aid Services for all need-based aid.
School of Aerospace and Mechanical Engineering

Farrokh Mistree, Ph.D., Director
David P. Miller, Graduate Liaison
212 Felgar Hall
Norman, OK 73019-1052
Phone: (405) 325-5011
FAX: (405) 325-1088
Internet: http://www.ame.ou.edu/

Faculty Roster
Aerospace Engineering: Professors Gollahalli, Gramoll, Miller, Mistree, Stalford, Striz; Associate Professor Parthasarathy; Assistant Professors Attar, Hawa, Vedula.
Mechanical Engineering: Professors Altan, Chang, Gan, Gollahalli, Gramoll, Miller, Mistree, Stalford, Striz; Associate Professors Baldwin, Lai, Parthasarathy, Siddique; Assistant Professors Hawa, Merchand-Merchan, Rennaker, Saha, Vedula.

Degrees Offered
• Bachelor of Science in Aerospace Engineering
• Bachelor of Science in Aerospace Engineering/Master of Science
• Bachelor of Science in Mechanical Engineering
• Bachelor of Science in Mechanical Engineering/Master of Science
• Master of Science
• Doctor of Philosophy

General Information
AEROSPACE ENGINEERING
Aerospace engineering is one of the most rewarding and challenging careers available. There is a fulfilling excitement in designing and building flying craft ranging from general aviation to high performance military aircraft and commercial airliners. There are also opportunities in the design and flight of spacecraft. Challenging space projects are awaiting the next generation of engineers. Aerospace technology has also expanded to include ground effect machines, helicopters, hydrofoil ships, high-power lasers, wind turbines, and high-speed rail vehicles, opening up even more career opportunities for aerospace engineers.

Careers
Aerospace engineers can expect to work in industries or government agencies whose mission is to design, test, manufacture or operate aircraft or spacecraft. Opportunities are available in private companies that build large commercial aircraft and companies that specialize in the smaller general aviation aircraft. Careers are available in military aircraft, missiles or spacecraft either in private industry or as an engineer employed by one of the military services.

Engineers employed by the National Aeronautics and Space Administration are involved in research, design, development and operation of the U.S. space program and in many aspects of aeronautics. Also many graduates find satisfying careers in applying the broad engineering knowledge acquired in the study of aerospace engineering to many other areas of technological development.

MECHANICAL ENGINEERING
Mechanical engineering is one of the most versatile of all engineering programs. Virtually all branches of industry employ mechanical engineers. The profession encompasses breadth, flexibility and the opportunity for great individuality. Mechanical engineers apply knowledge of thermal sciences, fluid and solid mechanics, and mathematics to design, develop, and build mechanical and electromechanical devices and systems. Since virtually all physical devices and systems have one or more mechanical aspects, mechanical engineering is almost always required in the design, manufacture and utilization of any technical product or system.

Careers
The career opportunities available to mechanical engineers are truly unlimited. Mechanical engineering plays a central role in all major industries including the aerospace, automotive, chemical, computer, construction, electrical, machinery, metals, petroleum and nuclear industries. Mechanical engineers are employed in virtually every technological field including industrial machinery, farm equipment, textiles, transportation, pharmaceutical, medical instrumentation, apparel manufacturing, electronics, soap and cosmetics, paper and wood products, education, utilities, and office machinery.

In these and other fields, mechanical engineers are involved in research, development, design, production and testing, construction, operations, sales, management, consulting, and teaching. Mechanical engineers are also employed in defense laboratories and in government where they hold positions of responsibility in state and federal government, in big and small corporations, and in private practice.

CURRICULUM IN AEROSPACE ENGINEERING
(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: 410-347-7700.)

PROGRAM EDUCATIONAL OBJECTIVES
• Our graduates will have acquired a strong foundation in science and engineering, which will facilitate research and development, advanced studies and lifelong learning.

Undergraduate Study
PROGRAM EDUCATIONAL OBJECTIVES

- Our graduates will have acquired a strong foundation in science and engineering, which will facilitate research and development, advanced studies and lifelong learning.
- Our graduates will be prepared for entry into the work force where they will be able to contribute to engineering enterprises and to take part in economic growth and job creation, while maintaining high professional and ethical standards.
- Our graduates will be exposed to the varied aspects of engineering design so that they can function in individual and team design situations.
- Our graduates will be able to utilize experimental and computational tools for the analysis of engineering systems.

PROGRAM OUTCOMES

- Students acquire basic principles of core engineering and relevant sciences.
- Students will gain an in-depth knowledge of the engineering subjects in their major and will be prepared to adapt to changing technologies.
- Students will be exposed to application and practice of the knowledge gained in 1A and 1B.
- Students will be exposed to the practice and constraints of contemporary industry nationally and globally.
- Students will have the opportunity to learn leadership, management, entrepreneurial skills, and professional ethics.
- Students will be able to apply their engineering knowledge to design engineering components and systems.
- Students will have the training to work in individual and team-oriented design problems with industrial applications.
- Students will gain the practice of communicating their design solutions through oral presentations and written reports.
- Students will be able to analyze and design solutions to contemporary engineering problems with computational tools.
- Students will be able to design and conduct experiments to tackle engineering problems.
- Students will be able to apply science and engineering principles to analyze and interpret computational and experimental results.
- Students will be able to communicate their findings through oral presentations and written reports.

This program requires a minimum of 128 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

CURRICULUM IN MECHANICAL ENGINEERING

(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: 410-347-7700.)

PROGRAM EDUCATIONAL OBJECTIVES

- Our graduates will have acquired a strong foundation in science and engineering, which will facilitate research and development, advanced studies and lifelong learning.
- Our graduates will be prepared for entry into the work force where they will be able to contribute to engineering enterprises and to take part in economic growth and job creation, while maintaining high professional and ethical standards.
- Our graduates will be exposed to the varied aspects of engineering design so that they can function in individual and team design situations.
- Our graduates will be able to utilize experimental and computational tools for the analysis of engineering systems.

PROGRAM OUTCOMES

- Students acquire basic principles of core engineering and relevant sciences.
- Students will gain an in-depth knowledge of the engineering subjects in their major and will be prepared to adapt to changing technologies.
- Students will be exposed to application and practice of the knowledge gained in 1A and 1B.
- Students will be exposed to the practice and constraints of contemporary industry nationally and globally.
- Students will have the opportunity to learn leadership, management, entrepreneurial skills, and professional ethics.
- Students will be able to apply their engineering knowledge to design engineering components and systems.
- Students will have the training to work in individual and team-oriented design problems with industrial applications.
- Students will gain the practice of communicating their design solutions through oral presentations and written reports.
- Students will be able to analyze and design solutions to contemporary engineering problems with computational tools.
- Students will be able to design and conduct experiments to tackle engineering problems.
- Students will be able to apply science and engineering principles to analyze and interpret computational and experimental results.
- Students will be able to communicate their findings through oral presentations and written reports.

This program requires a minimum of 122 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

PREMEDICAL ELECTIVE OPTION

The understanding of many physical phenomena associated with the human body is enhanced by the knowledge gained in the study of mechanical engineering. The fluid mechanics of the cardiovascular system, the kinetics and stress analysis of orthopedics, the dynamics of the auditory system are but a few examples of the interaction of mechanical engineering and medicine. Research and development of many diagnostic and treatment techniques are intimately interwoven with principles studied in mechanical engineering.

Students enrolled in the Mechanical Engineering B.S. curriculum and interested in studying medicine or dentistry may choose a premedical elective option. This elective option allows the student to earn a B.S. degree in Mechanical Engineering and satisfy the prerequisite course requirements for the University of Oklahoma’s medical or dental schools.

CURRICULUM IN MECHANICAL ENGINEERING—PREMED ELECTIVE OPTION

This program requires a minimum of 132 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

Pre-med students should consult their pre-med adviser as well as their Mechanical Engineering adviser for necessary medical school information.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).
The School of Aerospace and Mechanical Engineering offers a broad range of opportunities for advanced academic study and research in the fields of aerospace and mechanical engineering and in the underlying engineering sciences.

The following paragraphs present only the standard minimum requirements and are no more than guidelines, not intended to exclude consideration of any valid academic objectives. The admission evaluation, the academic plan, and the research studies of each student should represent a unique synthesis of program strengths and resources with that student’s background and aspirations.

Questions about the programs or about any specific requirement or consideration may be addressed to the AME Graduate Studies Coordinator at the School of Aerospace and Mechanical Engineering, 865 Asp Avenue, 212 Felgar Hall, University of Oklahoma, Norman, OK 73019-1052.

Areas of Specialization

There is a planned overlap of the graduate programs in these closely allied fields of the School, and several areas of specialization have evolved within and across these primary disciplines.

MECHANICAL ENGINEERING

These programs can be categorized into the focus areas of engineering information technology; materials, design and manufacturing; intelligent systems; bioengineering, and energy systems and propulsion. These include solid mechanics, fluid mechanics, thermal sciences and heat transfer, controls, robotics, engineering design, and bioengineering.

Current studies in solid mechanics include: experimental mechanics; plates and shells; buckling; structural dynamics; mechanical behavior of materials; analysis and processing of composite materials and structures; structural optimization; fatigue and fracture mechanics of metals and composite materials; and smart structures. Current studies in fluid mechanics include: computational fluid dynamics; compressible flows; viscous flows; non-Newtonian fluids; rheology; transport phenomena; turbulent jets and boundary layers; and multiphase flows. Current studies in thermal sciences include: theoretical and applied studies of radiative, conductive, and convective heat transfer; thermal properties of materials; combustion and flame dynamics; propulsion; gas turbine systems; mass transfer and handling of alternate fuels for automobile applications; biological heat transfer; heat transfer in porous media and EHD enhanced heat transfer. Current control studies include: design and analysis of control systems in MEMS; BioMEMS; micro systems and micro fluids; structural control; and non-linear, robust, autonomous, optimal, and real-time control of systems and vehicles. Current engineering design studies include: energy system design; materials in design applications; product and product family design; development and applications of computer-aided design and engineering; Internet-based design; tool integration for concurrent engineering; computer-integrated manufacturing; and rapid prototyping. Current studies in bioengineering include: biomechanics, biomaterials, cardiovascular physiology, implantable devices; soft and hard tissue engineering; and neural engineering. Current studies in robotics include the design and control of autonomous systems. Additional studies include: educational technologies; multimedia and informational technologies; energy policy; decision making under uncertainty; and renewable energy.

AEROSPACE ENGINEERING

These graduate programs offer opportunities for specialization in aeroservoelasticity; aerospace structures; structural and multidisciplinary design optimization (MDO); flight controls; aerodynamics; propulsion; combustion and flame dynamics; multiphase flows; robotics; intelligent systems; astrodynamics; space vehicle/mission design; computational fluid dynamics; and flight vehicle design and synthesis.

ENGINEERING ANALYSIS

Coordinated graduate programs share techniques of advanced engineering analysis, with current emphasis on finite element and quadrature element methods, differential quadrature, nonlinear analysis, variational calculus, perturbation methods, computational fluid mechanics, and optimization methodologies.

Research Facilities

The School of Aerospace and Mechanical Engineering laboratories are located in Felgar Hall, and the Engineering Research Center on North Campus. Specialized laboratories have been developed for combustion and propulsion, composite materials and structures, computational mechanics, dynamics, stress analysis and mechanical behavior of materials, fatigue and fracture mechanics, fluid flow and heat transfer, gas turbine systems, aerodynamics, laser velocimetry and fluid flow measurements, thermal imaging and radiative heat transfer, composite fuels, product and process design, computer-aided design, concurrent engineering, rapid prototyping, laser Doppler interferometry for vibration analysis, sound delivery, soft and hard tissue property analysis, multimedia and information technologies, robotics, advanced aircraft and spacecraft design, RPG model flight testing, multi-channel neural recording and stimulation, autonomous unmanned vehicles, telemetry and differential GPS systems, MEMS design, BioMEMS design and micro fluidics design. These laboratories are equipped with modern instrumentation and dedicated data acquisition systems. A network utilizing Sun workstations and a departmental PC laboratory with a host of commercial software packages are available for use in courses and research. In addition, the School participates in several multidisciplinary research centers including the Sarkeys Energy Center, Dynamic Structures, Sensing and Control Center, Biomedical Engineering Center, Center for Engineering Optimization, and Center for Aircraft and System Support Infrastructure.

Prerequisites for Full Graduate Standing

In addition to meeting the general requirements of the Graduate College, prospective students are expected to have previously earned a B.S. degree or its equivalent in the respective fields of aerospace or mechanical engineering. Students with baccalaureate degrees in other engineering disciplines, physical sciences or mathematics who meet the Graduate College requirements may be conditionally admitted to the AME graduate programs with the stipulation that they must complete specified undergraduate courses to correct identified deficiencies in their background.

In considering applicants for the graduate programs, the faculty looks for evidence of superior academic potential. This is most commonly indicated by the achievement of a grade point average of 3.00 or better on a scale of 4.00 (or an equivalent achievement as reflected in the grading system of the applicant’s previous education program) in the last 60 hours of an undergraduate degree. GRE scores, letters of reference, and the statement of purpose are also considered in the admission process. Applicants who have a strong research commitment and an intention to pursue graduate studies through the doctoral level are particularly encouraged. Details concerning the admission criteria and the required background courses may be obtained from the School of Aerospace and Mechanical Engineering.

Master of Science

The broadly structured requirements for the Master of Science degree in aerospace and mechanical engineering allow for two paths in completing an M.S. degree: a research-oriented plan of study involving the completion of an original research thesis, or a coursework-oriented plan of study providing expanded opportunities for formal instruction in advanced professional topics. These programs normally incorporate graduate-level courses in mathematics, science and advanced engineering science topics as well as some specialization in a specific area of aerospace or mechanical engineering. Each program is individually planned to meet the particular student’s needs and interest.
The M.S. degree with a research thesis requires completion of a minimum of 30 hours of approved graduate credit, including a maximum of six hours of thesis research; 12 or more hours of 5000-level AME courses, of which no more than three hours may be in special projects or guided individual studies; and three or more hours of approved mathematical-content courses. The remaining nine hours of the degree program should be chosen from approved electives in engineering, science, or mathematics, including 4000-level AME courses that are not required for the bachelor’s degree in the respective field (students who elect a two-hour laboratory course may include one additional hour of special projects or guided individual studies in their program).

The coursework-oriented plan of study requires additional graduate class enrollment in lieu of a research thesis. This program requires a minimum of 36 credit hours, including at least 18 hours of graduate-level AME courses of 5000-level or higher which may include up to three hours of special projects and up to three hours of guided independent studies (students who elect a two-hour laboratory course may include an additional one hour, up to a total of two hours, in either of these individual instruction enrollments); and at least three hours or more of approved mathematical-content courses. The remaining 12 hours of graduate credit should be chosen from other approved AME courses, including 4000-level courses not required for the B.S. degree in the major field, or from other fields of engineering, physical science, or mathematics (these electives may include up to three hours of additional enrollment in guided individual studies). This plan of study also requires satisfactory completion of the comprehensive examination covering the major fields offered for the degree program. The comprehensive oral examination is to be taken and satisfactorily completed prior to or in the projected final semester of a student’s M.S. program.

The School of Aerospace and Mechanical Engineering also offers an accelerated combined BS/MS program to qualified students. This program provides the opportunity for students to complete both the undergraduate and master’s degrees in five years.

More detailed information on the M.S. degree program and its requirements may be obtained from the Graduate Studies Coordinator of the School of Aerospace and Mechanical Engineering.

Doctor of Philosophy
The doctoral degree program is designed to prepare graduates for careers in teaching and research or in professional practice at the leading edge of their field. To enter the program, students are expected either:
(a) to have completed an appropriate master’s degree at the University of Oklahoma or elsewhere, or,
(b) to have otherwise demonstrated very strong academic abilities and research potential.

Prospective doctoral candidates are expected to complete their general examination after completion of 36 credit hours of graduate work, but before completing 60 credit hours of graduate (course and research) work.

The doctoral degree program demands a broad understanding of a chosen field and the development of the in-depth knowledge required to produce innovative research and design contributions to the field with minimal direct supervision. A minimum of 42 credit hours of coursework beyond the baccalaureate, in addition to the 42 hours of dissertation, is required. At least six of the course hours must be appropriate science and mathematics courses. At least 24 hours of the 48 hours of coursework shall be taken in advanced engineering courses.

Following formal admission to the doctoral program, the student and the student’s advisory committee will jointly plan a course of study designed to build upon the strength of each student’s prior background and to meet the specific needs and interests of the student and the requirements of his/her research program.

More detailed information on the doctoral program and its requirements can be obtained from the Graduate Studies Coordinator of the School of Aerospace and Mechanical Engineering.

Program in Bioengineering

Edgar A. O’Rear, Director, University of Oklahoma
Bioengineering Center
M. Ulli Nollert, Graduate Liaison
T-335 Sarkeys Energy Center
Norman, OK 73019-1004
Phone: (405) 325-5453
FAX: (405) 325-5813
Internet: http://www.oubc.ou.edu
E-mail: oubc@ou.edu

Faculty Roster
Professors K-H. Chang, Gan, Harrison, Liu, D. Miller, O’Rear; Associate Professors Fagg, Nollert, Rennaker, Schmidtke, Sikavitsas; Assistant Professors Ding, McFetridge, Starly; and participating faculty from the College of Engineering units on the Norman campus, OU Health Sciences Center, and Oklahoma Medical Research Foundation.

Degrees Offered
- Master of Science
- Doctor of Philosophy
- Doctor of Philosophy/Doctor of Medicine

General Information
OU has a rich research history in biomedical engineering based on the collaborative activities of professors on the Norman and Health Sciences Center campuses beginning nearly a quarter of a century ago with early research toward an artificial liver and pioneering work in the use of thermography for mammograms. Research has more recently led to important work in the areas of pharmaceuticals, immunology, imaging, implantable devices, software development, and tissue engineering. Based on this history and ongoing collaboration between professors on the Norman and Health Sciences Center campuses, the OU College of Engineering received a Special Opportunity Award in 1999 from the Whitaker Foundation to establish the Oklahoma Bioengineering Center (OBC) and create a graduate program. The Center is a cooperative program of the Schools of Aerospace and Mechanical Engineering (AME), Chemical, Biological, and Materials Engineering (CBME), Electrical and Computer Engineering (ECE), and Industrial Engineering (IE), along with the University of Oklahoma Health Sciences Center (OUHSC) and the Oklahoma Medical Research Foundation (OMRF). Nine new faculty members have been added to the Schools to expand research and teaching in bioengineering specialties. The graduate program emphasizes an interdisciplinary education designed to increase biological knowledge as well as the use of engineering analysis and techniques.

The facilities for OUBC are located in the buildings of the participating schools, Carson Engineering Center, Felgar Hall and Sarkeys Energy Center. Additional offices and laboratories were added in 2005 with the completion of special project space in the Peggy and Charles Stephenson Research and Technical Center. More new offices and facilities will be available in the next few years with the Devon Energy Hall and the Engineering Practice Facility.

All full-time faculty hold doctorates from such leading universities as Arizona State, Bath (U.K.), Buffalo, Cornell, Drexel, Illinois at Urbana, Iowa, Memphis, Minnesota, Rice, Southern California, Texas, Wisconsin, Worcester Polytechnic, and Yale.

BIOENGINEERING
Bioengineering is the use of engineering principles of analysis and design, and technologies to solve problems in medicine and biology. The goal of bioengineering research is to understand living systems and develop new
and improved devices and products for medicine and biology. Faculty work on important problems related to the treatment of cancer, heart disease, diabetes, otitis media, and other diseases and conditions. Research in bioengineering advances the health of the nation and provides technology that has contributed to the development of novel devices, drugs and systems. The principal objective of the graduate degrees in bioengineering is to provide a focused educational program in biomedical engineering for students seeking careers in industry, medicine, business and other fields related to biotechnology.

In addition to the M.S. and Ph.D. degrees in Bioengineering that are detailed below, students may choose to consider two other degree choices. The M.S. and Ph.D. degrees in traditional disciplines of engineering may be pursued with an emphasis on bioengineering offered by participating schools. Details about these degrees are available in the pages for the schools. These complementary programs allow the individual with an interest in bioengineering to follow a curriculum best suited to his/her needs.

**Undergraduate Study**

Undergraduate students and prospective students interested in biomedical engineering or bioengineering should follow the pre-med option available in the Schools of Aerospace and Mechanical Engineering (AME), web pages at coe.ou.edu/ame, or Industrial Engineering (IE), web pages at i.e.ou.edu, or the pre-medical/biomedical engineering option or biotechnology option available in the School of Chemical, Biological and Materials Engineering (CBME), web pages at cbme.ou.edu. These curricula provide a solid foundation in engineering and the biosciences that can be supplemented with elective courses and undergraduate research opportunities available from the University of Oklahoma Bioengineering Center. Accelerated B.S./M.S. degree programs offered may be of interest to some students. Among the courses offered are introduction to biomedical engineering, biochemical engineering, bioinstrumentation, neural engineering, biotransport, medical imaging, biomaterials, biomechanics, cellular and tissue engineering, and biosensors.

**Graduate Study**

The faculty of the OU Bioengineering Center are involved in a diverse array of research projects that aim to increase our understanding of the human body and that develop new and improved methods of diagnosis and treatment for a wide variety of disorders. For example, finite element computer models and laser doppler interferometry help researchers understand the mechanics of the ossicles and cochlea in conditions like otitis media with effusion. Several faculty members and their students are designing devices that can be implanted into the body to improve hearing or biosensors that incorporate nanotubes to sense the level of sugar in the blood of diabetic patients. We have a very active program in tissue engineering including tissue engineered blood vessels for cardiovascular bypass surgery as well as bone tissue for reconstructive surgery. Additional projects examine how implanted devices can be physically connected to the central nervous system. Some faculty are investigating the basic biochemical properties of various types of blood cells and how the functions of these cells are altered by the fluid mechanical environment found in the blood. Other faculty members are developing novel drug delivery strategies for targeting agents to kill cancer cells. Work is underway applying computational fluid dynamics to understand how renal artery aneurysms contribute to hypertension. Finally, some of the faculty are pioneering new methods to analyze images from x-ray and magnetic resonance imaging scans to detect cancer and other pathological conditions.

**Application Information**

In addition to meeting the general requirements of the Graduate College, any student with an undergraduate degree in engineering from an accredited school may be admitted as a student in full standing. It is recommended that students entering the program have taken at least one college biology course and one college organic chemistry course. A student with an undergraduate degree in the sciences may be admitted on the condition that specified undergraduate engineering and/or mathematics courses will have to be taken for completion of the degree program, which will depend on the background of each individual student. While here the masters and doctoral students will continue to follow the general procedures of the Graduate College for their level of degree as well as the procedures of the Bioengineering Program. More application information and application forms are available on the Web site at oubc.ou.edu.

**Master of Science**

The M.S. degree program requires 30 semester hours that can normally be completed in two years. A thesis is required. Coursework requirements for the Master of Science degree in bioengineering are the following:

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotechnology Principles</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>Three graduate-level bioengineering electives</td>
<td>9 hrs.</td>
</tr>
<tr>
<td>Two elective courses in the life sciences (chosen from the list of approved life science courses)</td>
<td>6 hrs.</td>
</tr>
<tr>
<td>Two graduate-level elective courses in engineering, science, or math</td>
<td>6 hrs.</td>
</tr>
<tr>
<td>M.S. Thesis</td>
<td>6 hrs.</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>30 hrs.</strong></td>
</tr>
</tbody>
</table>

**Doctor of Philosophy**

The Ph.D. degree in Bioengineering requires 90 post-baccalaureate hours, which include the courses required for the M.S. degree in Bioengineering and a minimum of nine additional hours of graduate level courses. Research credits make up the balance of the 90 hours. Three hours of this course work must be in the life sciences (graduate credit, chosen from the list below of approved life science courses), with the other six hours selected from engineering, science, or math courses (graduate credit) in consultation with the student's research supervisor. A student with a B.S. degree may enter the Ph.D. program directly; the student is not required to complete the M.S. thesis as part of the Ph.D. degree. At the end of the program, the student will demonstrate excellence in scholarly research by authoring a Ph.D. dissertation.

During the Ph.D. program, the student is required to take a general examination in accord with Graduate College requirements. For students entering with a B.S. degree, the general examination must be taken as soon as possible after the student has completed three semesters (not including the summer semester). For students entering with an M.S. degree, the general examination must be taken as soon as possible after the student has completed one semester (not including the summer semester).

**Bioengineering Courses:**

- AME 5710 Topics in Solid Mechanics: Neural Engineering
- AME/BIOE 5213 Biomechanics I
- AME/BIOE 5223 Biomechanics II
- AME/BIOE 5233 Biomaterials
- AME/BIOE 5253 Implantable Devices
- AME/BIOE/CH E 5203 Bioengineering Principles
- AME/BIOE/CH E 5293 Transport in Biological Systems
- BIOE 5960 Directed Readings
- BIOE 5970 Special Topics/Seminar
- BIOE 5980 Research for Master’s Thesis
- BIOE 5990 Independent Study
- BIOE 6970 Advanced Topics in Bioengineering
- BIOE 6980 Research for Doctoral Dissertation
School of Chemical, Biological and Materials Engineering

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Faculty Roster
Professors Bagajewicz, Grady, Harrison, Harwell, Lobban, Mallinson, O’Rear, Papavassiliou, Resasco, Shambaugh; Associate Professors Jentoft, Nollert, Schmidtke, Sikavitsas; Assistant Professors McFetridge, Striolo; Dean Emeritus Crynes; Emeritus Block, Daniels, Lee, Scamhohm, Sliepcevich, Starling.

Vision Statement
The vision of the School of Chemical, Biological and Materials Engineering is to serve the changing needs of society through the training of outstanding engineers in the creation and utilization of chemical engineering knowledge.

Degrees Offered
- Bachelor of Science in Chemical Engineering
- Bachelor of Science in Chemical Engineering: Biotechnology
- Bachelor of Science in Chemical Engineering: Pre-medical/Biomedical Engineering
- Accelerated Bachelor of Science in Chemical Engineering/Master of Science (Chemical Engineering)
- Accelerated Bachelor of Science in Chemical Engineering: Biotechnology/Master of Science (Bioengineering)
- Accelerated Bachelor of Science in Chemical Engineering: Pre-medical/Biomedical/Master of Science (Bioengineering)
- Master of Science
- Doctor of Philosophy

General Information
The School of Chemical, Biological, and Materials Engineering is charged with the responsibility for the undergraduate and graduate programs in chemical engineering. The faculty of this school reflects the variety of backgrounds and areas of specialization which contribute to these programs. All full-time teaching faculty hold doctorates from leading universities such as Padova (Italy), Bath (U.K.), Buffalo, California Institute of Technology, Case Western, Cornell, Georgia Tech, Houston, Illinois Institute of Technology, Ludwig-Maximilians-Universität München, Northwestern, Purdue, Rice, Texas, Wisconsin, and Yale.

CHEMICAL ENGINEERING
Perhaps the most striking facts about chemical engineering are youth and variety. At the turn of the century people were discontented with simply observing chemical phenomena in the laboratory. Chemical engineering was born out of the desire to use these chemical behaviors to serve people and make the world a better place in which to live.

The world has entered an extremely critical period because of shortages of nonrenewable energy. The chemical engineer is an important factor in solving problems in production and use of fossil fuel resources, nuclear energy and...
alternate energy resources. Chemical engineers have made important contributions to the production and refining of petroleum products. They are now playing an important part in liquefaction of natural gas and gasification of coal. The use of alternate energy sources such as biomass, geothermal, ocean thermal differences, and solar are dependent on contributions made by chemical engineers.

In the space age, chemical engineers are developing nanoengineered materials that will have structural and electronic properties never before encountered. They must perfect processes for life-support systems in other environments. Chemical engineers are needed to provide the fuels for rockets and booster propulsion. They utilize computers to control and analyze complex chemical processes.

Biotechnology and medicine, which have taken tremendous strides in the past few decades, are quite dependent on the efforts of the chemical engineer. It is the chemical engineer who develops ways to produce new recombinant proteins such as insulin at large scale for mass distribution. The vaccines that have saved a whole generation of children from crippling diseases are available because the chemical engineer worked out the ways to produce them safely and economically. The field of mental health has been revolutionized by drugs, and the demand for mental health care continues to grow. The field of environmental protection is also growing because of public awareness of the need for clean air and water.

The research chemical engineer has an analytical mind and likes to solve problems, while the production chemical engineer is better prepared to accept leadership in the community, as well as in the company, in a management capacity.

There are, of course, major fields besides industry that need chemical engineers. College teaching for instance, is offering more and more to the chemical engineer, particularly if the person is research-minded. Many college teachers are, in addition, consultants to industry, and the government too is constantly improving the opportunities for chemical engineers in its service. Private research institutes call for chemical engineers. A chemical engineer may choose to work in practically any field.

The curriculum in chemical engineering at the University of Oklahoma is planned to prepare students for the design, construction, and operation of industries in which materials undergo chemical, biological, and physical change. Graduates are prepared to accept a job in chemical engineering practice or to continue studies in graduate school.

Since the chemical engineer must be acquainted with so many diversified subjects, the education at the University is necessarily broad. Students receive solid foundations in mathematics, physics, chemistry, and engineering courses which will prepare them to apply effectively these fundamental principles to the solution of engineering problems. In addition, students in the biotechnology engineering elective patterns receive training in our pre-medical/biomedical life science and bioengineering courses. Because of the broad educational background, the chemical engineer is better prepared to accept leadership in the community, as well as in the company, in a management capacity.

Laboratory Facilities

Laboratories for chemical engineering are housed in two buildings, Sarkeys Energy Center and the Stephenson Research and Technology Center. We occupy a complex of over 24,000 square feet in the Sarkeys Energy Center. Facilities include a unit operations laboratory, separations and purification laboratories, polymers laboratories, small angle x-ray scattering laboratory, catalysis laboratories, thin films laboratory, biotechnology and biomedical laboratories, surfactants laboratories, and other graduate research project laboratories. The facilities in Stephenson includes laboratory areas specifically designed for bioengineering research, and we occupy over 3,000 square feet of the space shared with the Bioengineering Center. Areas of research emphasis include novel separation processes, remediation of polluted soil and water, process systems engineering, bone and vascular tissue engineering, rheology of blood, statistical mechanics, polymer fiber spinning and polymer characterization, biotechnology and biomedical engineering, advanced design, catalysis, electrochemistry, surface modification using ultrathin films, carbon nanotube production, and natural gas utilization.

Undergraduate Study

PROGRAM EDUCATIONAL OBJECTIVES

- For successful professional careers and personal lives and to meet the needs of employers and graduate schools, our graduates will have sound technical skills and core knowledge.
For successful professional careers and personal lives and to meet the needs of employers and graduate schools, our graduates will have strong interpersonal skills, ability for clear communication and sound group/team skills.

For successful professional careers and personal lives and to meet the needs of employers and graduate schools, our graduates will have proficiency in higher level thinking, including design and economics, synthesis, data interpretation, problem definition, analysis and integration.

For successful professional careers and personal lives and to meet the needs of employers, graduate schools and society, our graduates will possess ancillary knowledge associated with a general education, and understand the needs for life-long learning, ethical and professional behavior, and the necessity to contribute to society.

Courses designated as Core I, II, III, or IV are elements of the University-Wide General Education curriculum. All students are required to complete a minimum of 40 semester hours of General Education requirements to complete their curriculum. Each core area is listed with its specific components. Courses must be chosen from the General Education approved course list. Courses graded S/U or P/NP will not apply.

UNDERGRADUATE DEGREES
We offer the Bachelor of Science in Chemical Engineering degree. The three options and their emphases are described below.

CURRICULUM IN CHEMICAL ENGINEERING
(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

The “Standard Option” prepares students for a career in the wide variety of chemical process industries or for graduate engineering studies. Technical electives allow emphasis on energy, materials, process systems, environment, or other areas of interest.

This program requires a minimum of 126 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: [http://checksheets.ou.edu/engindx.htm](http://checksheets.ou.edu/engindx.htm).

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

CURRICULUM IN CHEMICAL ENGINEERING – PREMEDICAL/BIOMEDICAL OPTION PATTERN
(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

The pre-medical elective sequence is designed so that the student is prepared to enter schools of medicine, dentistry or osteopathic medicine as early as the end of the junior year. Most students who pursue a medical career complete the chemical engineering degree. If the student elects not to enter medical school, a normal chemical engineering degree is obtained, so there is no disadvantage of being in the program. Zoology courses useful in preparation for the Medical College Admission Test are scheduled in the junior year. The biomedical engineering pattern is similar to the pre-med pattern, differing in suggested technical electives.

Pre-med students should consult their pre-med adviser as well as their Chemical Engineering adviser for necessary medical school information.

This program requires a minimum of 135 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: [http://checksheets.ou.edu/engindx.htm](http://checksheets.ou.edu/engindx.htm).

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

ACCELERATED DUAL DEGREE B.S./M.S.

- Bachelor of Science in Chemical Engineering/Master of Science (Chemical Engineering) (144 credit hours)
- Bachelor of Science in Chemical Engineering: Biotechnology/Master of Science (Bioengineering) (146 credit hours)
- Bachelor of Science in Chemical Engineering: Premedical/Biomedical Engineering/Master of Science (Bioengineering) (153 credit hours)

The School of Chemical, Biological and Materials Engineering offers three accelerated dual degree (B.S./M.S.) programs to qualified undergraduate students. The programs allow students to pursue a graduate degree in conjunction with the undergraduate degree requirements. One program is for the B.S. and M.S. in Chemical Engineering, while the other two are for the B.S. in Chemical Engineering and M.S. in Bioengineering. Students admitted into these programs can use up to four courses (12 credit hours) to simultaneously satisfy the requirements of both the B.S. and M.S. degrees.

Students eligible to apply are the following:

- High school seniors with at least 17 hours earned through advanced standing exams and/or college-level courses in science and math in high school
- Undergraduate OU students majoring in Chemical Engineering with at least 8 hours of chemical engineering courses completed and OU retention and combined retention GPAs of 3.5 or higher.
- Students in the program must maintain an OU retention GPA of 3.25 or higher until completion of the program.

Applications are located in our department office or online at [http://www.cbe.ou.edu/undergrad/curriculum.htm](http://www.cbe.ou.edu/undergrad/curriculum.htm).

Graduate Study

Any student with an undergraduate degree in chemical engineering or its equivalent from an accredited school and a grade point average (GPA) of at least 3.00 (on a 4.00 scale) during the last 60 hours of undergraduate coursework may be admitted as a student in full standing.

Master of Science

Coursework requirements for the Master of Science degree are:

- Two graduate-level chemical engineering electives...................6 hrs.
Two graduate-level science, math, or engineering electives .......... 6 hrs.
Seminar (CH E 5971) ................................................................. 3-4 hrs.
M.S. Thesis ............................................................................... 6 hrs.
TOTAL ..................................................................................... 30-31 hrs.

A Master’s Examination and an M.S. thesis are required for the M.S. degree. The Master’s Examination is a written literature survey and research plan on the student’s thesis research.

Doctor of Philosophy

The Ph.D. in chemical engineering requires nine hours of coursework beyond the M.S. degree requirements including an Advanced Math requirement. These additional hours are selected from graduate-level engineering, science, or math electives in connection with the student’s research supervisor. Ninety post-baccalaureate hours are required for the Ph.D. which include research and coursework credits. It is possible for a good student to complete the requirements for the Ph.D. in a period of four years.

A student working towards a Ph.D. degree must pass a Qualifying Examination and a General Examination before being admitted as a candidate for this degree. The Qualifying Examination consists of written examinations in:
1. Thermodynamics,
2. Transport phenomena, and

The General Examination is a written literature review and analysis, research plan, discussion of preliminary research results, and development of new research ideas on the student’s Ph.D. dissertation research.

Curriculum for M.S./CH.E. Degree for Non-B.S./CH.E. Students

This curriculum has been designed to allow a student holding a Bachelor of Science degree in a field such as chemistry, physics, or mechanical engineering to complete the requirements for the Master of Science degree in chemical engineering over a period of approximately three years. The student will begin research during the first semester in the program. It is assumed that the student entering this program has completed the usual complement of chemistry, mathematics, and physics courses. This includes physical chemistry, organic chemistry and calculus. Any deficiencies in these areas will have to be included in the curriculum. A thesis is required.

If a student can demonstrate that he/she has already had courses covering some of the material in this curriculum, the student may use these courses as credit toward the M.S. degree. The only restrictions, imposed by the Graduate College are that no more than eight hours of graduate courses may be transferred, and that the courses have not counted toward an undergraduate degree. The graduate and undergraduate program directors will meet with each new student during registration to review his/her transcript, and determine if any modifications to the basic curriculum are necessary.

Courses required for this curriculum are outlined below.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH E 2033</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 3113</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 3123</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 3333</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 3432</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>CH E 3473</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 4153</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 4253</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 4473</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 5183</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 5843</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>CH E 5971</td>
<td>3-4 hrs.</td>
</tr>
<tr>
<td>CH E 5980</td>
<td>6 hrs.</td>
</tr>
<tr>
<td>CH E 6723</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>MATH 3113</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>Graduate science, math, or engineering elective</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>TOTAL</td>
<td>50-51 hrs.</td>
</tr>
</tbody>
</table>

Curriculum for Chemical Engineering—
Bioengineering Emphasis

The principal objective of the M.S. and Ph.D. graduate degree options in Bioengineering is to provide a focused educational program in chemical engineering for students seeking careers in industry, medicine, business and other fields related to biotechnology. Bioengineering is the use of engineering principles of analysis and design, and technologies to solve problems in medicine and biology. The goal of bioengineering research is to understand living systems and develop new and improved devices and products for medicine and biology.

Students interested in bioengineering should also consider the bioengineering degree programs offered through the Program in Bioengineering/OUBC as well as the options in traditional areas of engineering. The more intensive study of the OUBC degrees gives a greater range of employment prospects within bioengineering while the choice of pursuing the bioengineering option within chemical engineering can provide opportunities in other industrial sectors (e.g. the petrochemical industry) as well. These complementary programs allow the individual with an interest in bioengineering to follow a curriculum best suited to his/her needs. More information is on the OUBC Web page at [http://www.oubc.ou.edu/](http://www.oubc.ou.edu/).

Requirements for Master of Science —
Bioengineering Emphasis

Requirements for each student include a set of core courses and electives in chemical engineering, science, mathematics and bioengineering. Each student must also do a thesis and orally defend it in accordance with the policies of the School of Chemical, Biological and Materials Engineering (CBME) and the Graduate College. The M.S. degree program requires 30 semester hours and can normally be completed in two years.

Coursework requirements for the M.S. degree in Chemical Engineering—
Bioengineering emphasis include:

Three required graduate-level chemical engineering courses:
- Thermodynamics, Transport Phenomena, and Kinetics .......... 9 hours
- Two graduate-level bioengineering electives ............... 6 hours
- Two graduate-level life science electives (e.g. molecular biology, physiology, biochemistry) ................. 6 hours
- Seminar (1 hour/semester) ........................................... 3-4 hours
- M.S. Thesis ........................................................................ 6 hours

TOTAL ..................................................................................... 30-31 hours

Requirements for Doctor of Philosophy —
Bioengineering Emphasis

Requirements for each student in the Ph.D. Bioengineering emphasis include satisfactory completion of core courses and electives in chemical engineering, science, mathematics and bioengineering, passing qualifying exams and a comprehensive/general examination. The doctoral program requires 90 post-baccalaureate hours. Nine additional hours of graduate-level electives in bioengineering (3 hours), life sciences (3 hours), and mathematics/engineering (3 hours) beyond the M.S. are required, including an Advanced Math requirement. Each student must pass a qualifying exam and a general exam and also complete a dissertation and orally defend it in accordance with the policies of the School of Chemical, Biological and Materials Engineering (CBME) and the Graduate College.

Coursework requirements for the Ph.D. degree in Chemical Engineering —
Bioengineering emphasis include:

Three required graduate-level chemical engineering courses:
- Thermodynamics, Transport Phenomena, and Kinetics .......... 9 hours
- Three graduate-level bioengineering electives ............... 9 hours
- Four graduate-level math, life science or engineering electives .................................................. 12 hours
- Seminar (1 hour/semester) ........................................... 7-8 hours
- Ph.D. dissertation ......................................................... 53 hours

TOTAL ..................................................................................... 90-91 hours
School of Civil Engineering and Environmental Science

Robert C. Knox, Director
Gerald A. Miller, Graduate Liaison
334 Carson Engineering Center
Norman, OK 73019-1024
Phone: (405) 325-5911
FAX: (405) 325-4217
Internet: www.cees.ou.edu

Faculty Roster
Professors Butler, Kibbey, Knox, Kolar, Meo, G. Miller, Mish, Muraleetharan, Nanny, Sabatin!, Strevelt, Vieux, Zaman; Associate Professors Hong, Nairn, Pei; Assistant Professors Cerato, Hatami, Kang, Ramseyer; Emeritus Professor Laguros.

Degrees Offered
• Bachelor of Science in Architectural Engineering
• Bachelor of Science in Civil Engineering
• Bachelor of Science in Environmental Engineering
• Bachelor of Science in Environmental Science
• Bachelor of Science in Civil Engineering/Master of Science
• Bachelor of Science in Environmental Engineering/Master of Science
• Bachelor of Science in Environmental Science/Master of Science
• Master of Science (Civil Engineering and Environmental Engineering)
• Master of Environmental Science
• Doctor of Philosophy

General Information
Architectural engineers are responsible for making buildings work properly in the real world, including the structural design responsibilities that insure that buildings can effectively resist loads such as gravity and wind. In addition to making sure that buildings can stand up against such natural forces, architectural engineers are also responsible for the design and installation of the environmental systems that buildings require, including heating, air-conditioning, and electrical power systems. These engineers also often possess the skills required to manage the construction of buildings and other large structures. Architectural engineers work closely with architects so that the architectural form of a building is preserved, while insuring that buildings are safe from natural hazards and that they provide secure and comfortable surroundings for their occupants. Many architectural engineers are employed in government service, but many others practice in the private sector for small and large engineering consulting firms. Current areas of growth for architectural engineers include development and deployment of sustainable technologies such as solar energy and other renewable energy systems for heating and cooling. Students interested in structural engineering, construction management, and design of building environmental systems will find exciting and interesting careers in the architectural engineering profession.

Environmental engineers promote harmony between human development and the environment. The availability of abundant supplies of clean water is vital to a high standard of living; environmental engineers identify and develop such resources. Once used, systems must be designed to treat the resulting wastewater before discharging it into the environment. Environmental engineers design systems to protect the environment from the discharge of all solid, liquid and gaseous wastes. At times the environmental engineer is called upon to design systems for remediating contaminated sites (e.g., Superfund sites) in such a way that preserves the environment and protects human life. In a more proactive way environmental engineers seek to minimize waste generation and reduce the potential for environmental and human exposure to these wastes. Geotechnical engineers are involved with geotechnical aspects of many different environmental projects, such as designing and constructing clay liners for landfills. This trend has spawned a new specialty area, geoenvironmental engineering.

Environmental scientists examine the connections and interactions of humankind and the living and nonliving natural environment. They integrate studies of the problems and issues related to contaminant fate and transport, pollution treatment and control, resource use and consumption, environmental conservation, preservation and enhancement, and environmental management. They often interact with regulatory programs, and participate in the development of remediation strategies. Environmental scientists may be employed in various governmental agencies, consulting firms, laboratories, or in many different private industries.

The School of Civil Engineering and Environmental Science (CEES) provides broad based education for architectural, civil and environmental engineers and for environmental scientists. For undergraduate engineering majors,
the first two years of study concentrate on the fundamentals of mathematics and engineering science, in common with all engineering students. Using this as a foundation, the last two years of civil engineering include required courses in soil mechanics, structural analysis and design, environmental engineering, hydraulics and hydrodynamics. In the senior year professional electives enable development in one of the sub-areas of civil engineering. Students are encouraged to choose electives in structural, geotechnical, geoenvironmental, environmental, or water resources engineering. The curriculum for the undergraduate program in environmental engineering is similar to that of the civil engineering undergraduate program for the first two years. However, during the last two years, students complete coursework which is more focused on the environmental applications of civil engineering. The technical electives cover the areas of hydrology, water and wastewater treatment, solid and hazardous waste, and environmental science and occupational health. Students enrolled in the architectural engineering program take the same core engineering, mathematics, science, and English courses taken by other engineering students. They also take a series of architectural planning, design and studio courses from the College of Architecture. During the last two years, they take structural engineering courses from CEE.

Environmental scientists must keep pace with changing environmental concerns and areas of emphasis. In addition, the wide range of environmental management opportunities requires that the environmental scientist be well trained in the fundamental physical and biological sciences. Accordingly, the undergraduate environmental science curriculum focuses on the fundamentals of mathematics, chemistry, life sciences (zoology, microbiology, botany) and environmental science for the first three years, with professional and track electives during the senior year. Undergraduate students also take courses in English, political science, history, and humanities. The successful engineer or scientist must be able to communicate ideas and plans with colleagues and supervisors. He or she understands that the professional responsibility of the engineer or scientist is to provide cost-effective technological solutions that meet the growing needs of society.

Special Facilities and Programs

RESEARCH FACILITIES

CEES has laboratories to support both its teaching and research missions in environmental science, environmental engineering, structures, hydraulics, soil mechanics, and highway materials.

The Fears Engineering Laboratory, gaining national recognition as a center of structural and geotechnical engineering research, was constructed in 1979 and was recently renovated to promote the effective integration of structural engineering with information technology. It has 8,400 square feet of laboratory space, including a 1,800-square-foot reaction floor that can handle 320,000 pounds at any one location and accommodate testing configurations up to 22 feet high.

The Environmental and Ground Water Institute (EGWI), established in 1982, is a pioneer in conducting water-related research. Through collaboration with the Institute for Applied Surfactant Research (IASR), EGWI researchers have developed subsurface remediation and solvent replacement technologies. EGWI research also evaluates the transport and fate of contaminants in the environment (e.g. pharmaceutical and personal care products) and develops new water treatment processes (e.g., arsenic removal). In 2005 EGWI spawned development of the WaTER Center. The vision of the WaTER (Water Technologies for Emerging Regions) Center is a world in which all humankind has safe, reliable drinking water. Thus, the center’s mission is to help solve drinking water challenges for emerging regions, both internationally and locally, through innovative teaching and research initiatives. In all these activities, EGWI actively engages undergraduate students in the research enterprise. The Center for Restoration of Ecosystems and Watersheds (CREW) focuses on the evaluation of environmental impact and development of sustainable environmental remediation and restoration technologies. The objectives of this center are to develop comprehensive, sustainable and economically viable remediation and restoration strategies to solve environmental problems, couple these technologies with economic stimulus for local communities, and transfer these technologies to stakeholders for implementation. CREW has expertise in ecological engineering, wetlands science, biogeochemistry, microbial geochemistry, applied environmental microbiology, bioenvironmental engineering, waste reuse and recycling, contaminant fate and transport and water quality management. Laboratory capabilities include analysis of inorganic and organic constituents in surface and ground water, soils, sediments, air and manufactured products.

CEES maintains geotechnical engineering and unsaturated soil mechanics laboratories in the Carson Engineering Center (CEC). The Ray Broce Materials Laboratory located in the Engineering Lab (EL) building has facilities for testing of pavement materials including conventional and performance-related testing of asphalt mixes. Most laboratory equipment in these labs is connected to fully automated data acquisition systems. Facilities for evaluation of rheological properties of asphalt binders are available in the Asphalt Rheology Laboratory located in the Sarkeys Energy Center.

Several computer systems within CEES and OU support numerical and analytical research and teaching. Computing hardware ranges from Intel-based PCs to supercomputers available through OU Supercomputing Center for Education and Research (OSCR, http://www.oscr.ou.edu/). OUC is part of the Internet 2 consortium and high-speed access to the Internet is ubiquitously available on- and off-campus. Currently, OSCR maintains three high performance computing platforms, which between them have a total peak performance of nearly 1.5 TFLOP/s (trillion calculations per second). These platforms include a Linux cluster consisting of 270 2.0 GHz Pentium4 Xeon processors. OU also supports a wireless network in many buildings and classrooms that allows for interactive laptop applications in teaching.

In addition to the facilities provided by Engineering Computing Services, CEES maintains three computer laboratories and a student computing and study facility. The Geographic Information Systems (GIS) and Modeling Laboratory is a specialized computing facility devoted to scientific visualization and modeling of spatially distributed environmental parameters and processes. The computing infrastructure in the Environmental ModelingGIS lab was upgraded in Summer 2005. It now consists of a network of Sun UltraSPARC and Pentium-based workstations running Solaris, Linux, and Windows operating systems, all connected to a Sun Enterprise 250 server. The lab also maintains a 24-node Sun Netra XI (SPARC/Solaris-based) cluster and 2 SunFire V20z dual processor AMD Opteron compute servers. Peripherals include large LCD monitors, disk arrays, tape backups, and color and black and white printers. The lab is housed in a comfortable work environment, with student desks separated from the computer stations.

The Geo-Computational Computer Modeling Lab contains eight PCs, and associated peripherals. Licens for specialty geotechnical engineering software such as FLAC and TeraScale Dyacs are also available in this lab.

The TEAM AutoCAD Laboratory is used primarily by students completing the capstone course (CE 4903 or ES 4913), although the long-term plan is to allow students to utilize the lab for any of the Sooner City design courses. The lab currently features six Dell L667 workstations, a HP 600 plotter, a HP Designjet 800 color plotter, two HP scanners, and a HP Laserjet printer. Each workstation is equipped with AutoCAD, Eagle Point, and other engineering design software. Furniture (e.g., chairs, computer benches, drawing lay tables), flat files, and hanging files give the lab the appearance of a real world engineering office.

The CEES student computing and study facility is unique in the College of Engineering. The facility includes seven Gateway or Micron workstations hardwired to the campus network. In addition, the room has been equipped with a receiver for the wireless network. Computer stations are located on the periphery of the room with ample tables and chairs in the interior to accommodate students using laptop computers.

Undergraduate Study

BACHELOR OF SCIENCE IN ARCHITECTURAL ENGINEERING

(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)
PROGRAM EDUCATIONAL OBJECTIVES
- The Architectural Engineering Bachelor of Science alumni will have embarked on successful careers in the areas associated with the development, implementation, and management of architectural engineering systems.
- The Architectural Engineering Bachelor of Science alumni will advance in their careers and continue their professional development through continuing education and lifelong learning.

PROGRAM OUTCOMES
- Graduating seniors will be technically competent in core areas within architectural engineering and related sciences and mathematics;
- Graduating seniors will be able to work within a team and communicate effectively;
- Graduating seniors will be able to synthesize diverse information to develop creative and ethically sound design solutions;
- Graduating seniors will be able to function in an evolving engineering practice;
- Graduating seniors will understand the importance of continuing education, professional registration, and ethical responsibilities; and
- Graduating seniors will be able to work within a team, develop project management skills and communicate effectively.

This program requires a minimum of 129 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING
(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

PROGRAM EDUCATIONAL OBJECTIVES
- The Environmental Engineering Bachelor of Science alumni will have embarked on successful careers in the areas associated with the development, implementation, and management of architectural engineering systems.
- The Environmental Engineering Bachelor of Science alumni will advance in their careers and continue their professional development through continuing education and lifelong learning.

PROGRAM OUTCOMES
- Graduating seniors will be technically competent in core areas within environmental engineering and related sciences and mathematics;
- Graduating seniors will be able to work within a team and communicate effectively;
- Graduating seniors will be able to synthesize diverse information to develop creative and ethically sound design solutions;
- Graduating seniors will be able to function in an evolving engineering practice;
- Graduating seniors will understand the importance of continuing education, professional registration, and ethical responsibilities; and
- Graduating seniors will be able to work within a team, develop project management skills and communicate effectively.

This program requires a minimum of 125 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: checksheets.ou.edu/engrindx.htm.

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

BACHELOR OF SCIENCE IN ENVIRONMENTAL SCIENCE

This program requires a minimum of 126 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

Graduate Study

The School of Civil Engineering and Environmental Science offers master’s and doctoral programs in civil and environmental engineering and environmental science.

The following paragraphs present only the standard minimum requirements and are no more than guidelines, not intended to exclude consideration of any valid academic objectives. The admission evaluation, the academic plan, and the research studies of each student should represent a unique synthesis of program strengths and resources with the student’s background and aspirations.
Areas of Specialization

Environmental engineering, environmental science, geotechnical engineering, groundwater quality management, structural engineering, water resources and water quality management. Selection of an option should be made as early as possible, but not later than the regular enrollment period for which the student will have accumulated 15 hours of graduate credit. An early decision is strongly encouraged because all options may not be available at all times. A graduate student is admitted into an area of specialization; any subsequent change in the area of specialization is to be petitioned to the School of Civil Engineering and Environmental Science Graduate Studies Committee. Usually a change is permitted if the student is in good graduate standing and meets the entrance criteria of the specialty area.

Prospective students can obtain additional information through the School’s website (http://cees.ou.edu) or application materials may be requested by writing to the School or contacting the graduate programs assistant by e-mail (srwilliams@ou.edu).

Financial Assistance

Applications for financial assistance should be directed to the School of Civil Engineering and Environmental Science. Research assistants typically write their thesis or dissertation on the subject for which financial support is received. Teaching assistants often teach laboratory sections and/or grade papers. Instructors’ positions are occasionally available for advanced graduate students, particularly those interested in a university teaching career. Graduate students whose native language is not English must pass an English proficiency exam before being allowed positions as instructors.

Accelerated Dual Degree B.S./M.S.

The School of Civil Engineering and Environmental Science offers Accelerated Dual Degree (B.S./M.S.) programs to qualified undergraduate students. The programs allow students to pursue a graduate degree in conjunction with the undergraduate degree requirements. Students accepted into the programs can use two professional elective courses (six credit hours) to simultaneously satisfy the requirements of both the B.S. and M.S. degrees. With proper planning, the Accelerated BS/MS Programs allow students to complete their MS Thesis or non-thesis degree requirements in less time than is possible in the traditional program.

Students are encouraged to apply two semesters prior to graduation and must have a GPA of 3.2 or better in their undergraduate curriculum. The programs are not available to transfer students beyond junior standing. Final acceptance to the graduate program is subject to approval of the CEE Graduate Studies Committee and Dean of the Graduate College.

Master of Science (Civil Engineering or Environmental Engineering)

For admission to an area of specialization leading to the Master of Science degree in Civil or Environmental Engineering, the student must meet the general requirements of the Graduate College and must have previously fulfilled the requirements equivalent to the Bachelor of Science in Civil or Environmental Engineering. In addition, the student must have taken the Graduate Record Examination. Undergraduate background deficiencies will be determined by the School’s Graduate Studies Committee and must be satisfied before the student is granted full admission to the Graduate College. All students admitted must have a combined score of 1,000 on the verbal plus quantitative portions of this examination. Typically, applicants who are offered financial assistantships achieve a combined score well above 1,000. International applicants must have a TOEFL score of 550 or higher.

International applicants must have a TOEFL score of 550 or higher. Quantitative portions of this examination. Typically, applicants who are offered financial assistantships achieve a combined score of 1,000 points on the verbal plus quantitative portions of this examination. The graduate Ph.D. degree requires a master's degree with a high scholastic standing. All students admitted must have a combined score of 1,000 on the verbal plus quantitative portions of this examination. Typically, applicants who are offered financial assistantships achieve a combined score well above 1,000. International applicants must have a TOEFL score of 550 or higher.

At least 17 credit hours of 5000-/6000-level civil engineering courses that have been approved by the student's adviser are required. No more than five of the total credit hours, may be S/U graded. Additional courses to complete the 32 credit-hour requirement can be chosen from other fields of engineering, sciences, mathematics, business or the arts.

Doctor of Philosophy

The Doctor of Philosophy degree program is concerned with the expansion of professional knowledge in the fundamental concepts of civil engineering or environmental science. Admission to the Ph.D. program requires a master's degree with a high scholastic standing. All students admitted must have a combined score of 1,000 on the verbal plus quantitative portions of this examination. Typically, applicants who are offered financial assistantships achieve a combined score well above 1,000. International applicants must have a TOEFL score of 550 or higher.

As part of the Ph.D. degree, the student is expected to produce a research dissertation of professional significance that could be the basis of one or more papers published in refereed journals. Ninety semester hours of graduate-level coursework beyond a B.S. degree are required plus a qualifying examination, a general examination, proficiency in a research skill and an acceptable dissertation. The graduate Ph.D. is prepared for a career in teaching, research and consulting.
School of Computer Science

Sridhar Radhakrishnan, Director and Graduate Liaison

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Professors Antonio, Atiquzzaman, Dhall, Gruenwald, Kim, Lakshminarahan, Page, Radhakrishnan, Thulasiraman; Associate Professors Cheng, Fagg, Hougen, Trytten; Assistant Professor McGovern; Adjunct Professors Miller, Neeman, Ray, Wu.

Degrees Offered
• Bachelor of Science in Computer Science
• Bachelor of Science in Computer Science/Master of Science (in Computer Science)
• Bachelor of Science in Computer Engineering/Master of Science (in Computer Science)
• Master of Science
• Doctor of Philosophy

General Information
Computer scientists design and build computer systems for technical applications such as intelligent robotic systems, computer graphics and graphical interfaces, modeling and simulation, high-performance computing, information storage and retrieval, network communications, network security, speech recognition, and automated controls. Computer scientists also build software tools to facilitate the use of computing systems, tools such as word processors, spreadsheets, numerical function libraries, programming language translators, operating systems, and database management systems.

Computer scientists involved in research invent and analyze formal notations for describing computations, algorithms effective for specific applications, schemes for data storage and retrieval, and methods for managing the complexity of large bodies of software. They study the limits of computation, and they apply computing theories to practical problems.

Computer manufacturers and software companies employ computer scientists to design tools to assist in software development. Such systems include compilers, network software, graphical interface generators, database access systems, and resource managers. In addition, many other industries employ computer scientists to help apply computing technology in applications such as the design of automobile and aerospace components, analysis of chemical processes, economic and financial modeling, pharmaceuticals research, earth resource exploration, weather modeling and intelligent robotics.

The use of computer technology continues to expand, and employment opportunities for computer scientists seem likely to follow this pattern of growth. The curriculum provides students with an opportunity to acquire the comprehensive education necessary to build a successful career in computer science.

Programs for Academic Excellence
The University’s Honors Program affords opportunities for intellectual and professional development under the tutelage of professors selected by the students.

RESEARCH ACTIVITIES
The faculty includes internationally recognized experts in many aspects of computer science. They are active in professional research and practice, have published major texts, and have won awards from professional societies for both teaching and research.

Faculty research interests include parallel and distributed computing, telecommunication and computer networks, interconnection networks, high-performance computing, computer graphics, database systems, information privacy and security functional programming, computational graph theory, discrete optimization, intelligent systems, robotics, molecular computing, cryptography, CS education, software engineering, and theoretical computer science.

Computing Facilities
The School of Computer Science maintains several research laboratories. In addition, the School operates an educational laboratory equipped with high-performance workstations and a number of PCs. The School also maintains a high-performance cluster for education and research in distributed computing, networking, and operating systems. Additional computing facilities are available to students at many locations on campus. All students have access to the Internet, and electronic mail services.

Undergraduate Study

CURRICULUM IN COMPUTER SCIENCE
(Accredited by the Computing Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

Program Educational Objectives
The program educational objectives are:
• Graduates succeed in problem solving professions using computer science expertise.
• Graduates succeed in software design and development careers.
• Graduates may pursue or complete advanced degrees in computer science or other fields.

Program Outcomes
The program enables students to achieve, by the time of graduation:
• An ability to apply knowledge of computing and mathematics appropriate to the discipline.
• An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
• An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
• An ability to function effectively on teams to accomplish a common goal.
• An understanding of professional, ethical, legal, security and social issues and responsibilities.
• An ability to communicate effectively with a range of audiences.
• An ability to analyze the local and global impact of computing on individuals, organizations, and society.
- Recognition of the need for and an ability to engage in continuing professional development.
- An ability to use current techniques, skills, and tools necessary for computing practice.
- An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- An ability to apply design and development principles in the construction of software systems of varying complexity.

This program requires a minimum of 120-121 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: [http://checksheets.ou.edu/engrindx.htm](http://checksheets.ou.edu/engrindx.htm).

Three of the 12 General Education elective hours (one course each from Social Science, Artistic Forms, Western Civilization, and Non-Western Culture) must be at the upper-division level (3000-4000).

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

## Graduate Study

### Areas of Specialization

Current research activities in computer science span a variety of areas of specialization in the respective disciplines as well as a variety of interdisciplinary subjects. Research activities include computer architecture, parallel and distributed computing, telecommunication networks, interconnection networks, computer graphics, database systems, information privacy and security, functional programming, computational graph theory and discrete optimization, intelligent systems, robotics, cryptography, molecular computing, software engineering, and theoretical computer science.

### Support

Financial assistance to qualified graduate students is available from the School of Computer Science and from other sources. The School awards scholarships, graduate teaching assistantships, and research assistantships. Students desiring financial assistance are encouraged to contact the Graduate Liaison of the School of Computer Science and complete an application. Many graduate assistantships include out-of-state tuition waivers.

### Requirements for Admission

Students with baccalaureate degrees in other engineering disciplines, physical sciences or mathematics who meet the general requirements of the Graduate College may be conditionally admitted to the Computer Science graduate programs with the stipulation that specified undergraduate courses must be satisfactorily completed to correct deficiencies in their background. GRE General Examination scores are required. Three letters of recommendation that evaluate the candidate’s potential for success as a graduate student are required.

Specific questions concerning the programs or admission requirements may be addressed to the Graduate Liaison, School of Computer Science, 200 Felgar St., Room 144, Norman, OK 73019. Inquiries should be directed to the program assistant (405) 325-0145.

### Accelerated Dual Degree B.S./M.S.

The School of Computer Science offers an accelerated dual degree (B.S./M.S.) program to qualified undergraduate students. The program allows students to pursue a graduate degree in conjunction with the undergraduate degree requirements. Students admitted into this program can use up to four courses (12 credit hours) to simultaneously satisfy the requirements of both the B.S. and M.S. degrees. Students generally apply for the program two or three semesters before completion of the B.S. degree. Minimal requirements for this program include a 3.5 GPA at the time of application. In addition to a dual degree program in which both degrees are in Computer Science, the School of Computer Science in cooperation with the School of Electrical and Computer Engineering offers a dual degree program in which the B.S. degree is in computer engineering and the M.S. degree is in computer science.

### Master of Science Degree

A student can pursue either a thesis program or a nonthesis program. In the thesis program, a student is required to complete 30 hours of C S graduate-level courses (including up to six hours of thesis work). In the nonthesis program, the student is required to complete 33 hours of C S graduate-level courses. For either plan, no more than 12 hours of the graduate work can be at the 4000-level (with a maximum of nine hours being in C S). Up to six hours of graduate credit may be in courses from other departments, provided that the courses have been previously approved by the graduate adviser.

Students in the thesis option are required to write a thesis, and successfully defend it before an examination committee. The nonthesis option students are required to pass a final oral comprehensive examination administered by a committee. Students should consult the C S Graduate Handbook for specific degree requirements.

### Doctor of Philosophy Degree

Requirements for the Ph.D. degree are set by the student’s doctoral committee in conformance with the current rules of the Graduate College. A qualifying examination is required of all students. The intent of the examination is to determine whether the student is qualified to undertake a doctoral program and, further, to reveal deficiencies that may exist in his/her academic preparation for the doctoral program.

In addition, every student is required to take a general examination in his/her major field of study and the related areas. Doctoral students perform research in an area of interest and write a dissertation. Students should consult the C S Graduate Handbook for specific degree requirements.
School of Electrical and Computer Engineering

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Faculty Roster
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Degrees Offered
• Bachelor of Science in Computer Engineering
• Bachelor of Science in Electrical Engineering
• Bachelor of Science in Computer Engineering/Master of Science (Computer Science)
• Bachelor of Science in Computer Engineering/Master of Science (Electrical and Computer Engineering)
• Bachelor of Science in Electrical Engineering/Master of Science (Electrical and Computer Engineering)
• Master of Science (Electrical and Computer Engineering)
• Master of Science in Telecommunications Engineering
• Doctor of Philosophy (Electrical and Computer Engineering)

Academic Objectives
The mission of the School of Electrical and Computer Engineering is to provide a high-quality educational experience for undergraduate and graduate students. Objectives to support this are to offer innovative curricula which prepare the students for successful careers, to broaden the learning experience through the use of technology in the classroom, to provide perspective to knowledge by integrating faculty research into the classroom, and to relate knowledge to contemporary problems with Laboratory experiences. The products of this experience are engineers who are able to think creatively, to advance their knowledge of technology, and to contribute to the creation of economic growth.

General Information
The University of Oklahoma since its inception in 1906 at the University of Oklahoma. Historical highlights of the School include:

1906: Moved from Applied Science to College of Engineering; 1972: Computer Science combined into the School; 1992: Electrical Engineering and Computer Science became separate Schools within the College of Engineering; and 1996: Curriculum reorganized to support both Electrical and Computer Engineering degrees.

The faculty of the School of Electrical and Computer Engineering (ECE) is committed to excellence in teaching, quality research in selected areas of leading edge technology, and the professional development of students.

Having Electrical Engineering and Computer Engineering in a single School offers the student an exciting combination of technologies with which to meet the design problems of the twenty-first century and an opportunity to develop hands-on skills at the device and system levels. Each degree is based on class offerings from both specialties within ECE, augmented by classes from the School of Computer Science and the Department of Engineering. With this balance, the student is prepared to handle both hardware and software design and analysis topics. Engineering research and career applications include bioengineering, communications, computer architecture, solid state devices and materials, electric power and radio frequency systems, image and signal processing, instrumentation and control systems, and linear and digital electronics. The School participates with other Colleges to develop advanced degrees specializing in electric energy management, bioengineering and telecommunications systems technologies.

Programs for Academic Excellence
ECE students who qualify may choose to participate in the University’s Honors College. This program affords unusual opportunities for intellectual and professional development under the tutelage of professors selected by the student.

The School offers the opportunity to become involved in undergraduate research. Students who qualify and are interested in participating in ongoing research programs may do so through special project courses, summer employment on a research grant or part-time employment during the academic year. This is especially encouraged for students interested in our five-year MS programs.

ECE students participate in design courses which culminate in an industry sponsored, Senior Project. This capstone course provides an opportunity to experience the complete engineering design process under the performance, schedule and cost constraints required for a product to survive in the engineering environment.

Students may participate in many professional activities and organizations including student chapters of the Institute of Electrical and Electronic Engineers (IEEE) and the Association for Computing Machinery (ACM). Each year students are selected to participate in regional and national professional contests. The school has an active chapter of the electrical engineering honor society, Eta Kappa Nu (HKN), which selects its members from the upper quarter of the junior class and the upper third of the senior class.

Graduate students have an opportunity to select a research topic in one of the many exciting research programs being pursued by our faculty. In many cases, these research programs have funding to support the student participants during the period of their thesis studies. While research activities and projects change rapidly, a brief survey of our current research activities is included here to illustrate our many programs of excellence for graduate students.

Research Activities
ECE faculty are currently engaged in research in a number of areas of technology critical to advancement of knowledge and commerce in the US and the State of Oklahoma.

• Bioengineering — Instrumentation, medical imaging, biomedical optics, digital hearing aids, physiological modeling, bio-computing; interactions of electromagnetic fields and biological tissue.
• Communications — Adaptive antenna arrays, fixed wireless access, wideband CDMA, wireless telemetry systems, equalization and coding for storage.
• Computer Systems — Advanced computer systems and architecture, fault tolerant systems, networking, embedded systems, programmable logic, hardware design languages.
• Electric Power Systems — Power systems planning and operation; electric power network economics; regulation, privatization and competition in network.
Electric Vehicle Research — High efficiency motor control systems, battery systems, ergonomic subsystems, solar power and formula racing vehicles.

Electromagnetics — Computational electromagnetics, phased array antennas, RF medical applications.

Image Processing — Digital image processing, computer vision, robotics vision, pattern recognition, image interpretation.

Intelligent Systems — Soft computing, neural networks, fuzzy logic modeling, solution programming, optimization, artificial intelligence, genetic algorithms.

Instrumentation and Control Systems — Multivariable controls design and analysis, robust and fuzzy logic controls, GPS flight control and location systems.

Sensor Electronics — Integration of state-of-the-art optoelectronic components with high performance embedded processors, design and fabrication of analog/digital mixed-signal circuits, and development of chemical and biological sensors based on fluorescence, laser absorption and Raman scattering spectrocopies — all of which are integrated around a common platform for low-cost, low-power consumption deployment.

Signal Processing — Speech and image representations for enhancement, compression, synthesis and recognition systems. Adaptive systems for telecommunications, multimedia, and other systems. Digital filter methods and implementations.


Telecommunications Engineering — Wireless and fiber optic networking technology, systems interoperability, security.

Weather Radar — Radar detection and signal processing, adaptive processing, phased arrays, weather detecting waveforms and filtering.

Admission to the Program

ECE is aggressive in selection of well-rounded students who have demonstrated ability to succeed in academic pursuits. Students declaring Electrical Engineering and Computer Engineering majors will be admitted to the program essentially at the end of their sophomore year. Qualification for entry is established by making application that shows completion of a set of eight required, undergraduate courses in math and sciences.

Successful applicants may then begin taking upper division (3000- and 4000-level) ECE courses. Transfer students must enter with a 3.0 GPA and successfully pass 12 hours of curriculum required coursework with a 2.80 GPA before full admission to the program. Exact details of this plan are available on our website at ece.ou.edu.

Special Facilities and Programs

Excellent facilities are available for advanced studies in digital systems, power systems, digital signal processing, intelligent transportation systems, alternate energy, GPS, weather radar and instrumentation, communication, opto-electronics and solid state electronics. The School operates and maintains a variety of computers, a microprocessor lab, a power systems simulator lab, a digital signal processing lab and other instructional and research laboratories. The facilities are used to provide “hands-on” experience for students. The Electrical Engineering and Computer Engineering programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Biomedical Optics and Electronic Imaging Laboratories

The facilities support advanced research and teaching in medical imaging and biomedical optics. One laboratory is located in Stephenson Research and Technology Center that contains state-of-the-art equipment, such as X-ray sources; custom developed CCD and other electronic detector systems, and computing resources. Another laboratory is located in the OU Medical Center to foster collaboration with clinicians. The equipment includes digital x-ray imaging systems, digital fluorescent imaging systems, optical tables, and lasers.

Center for Intelligent Systems

Research lab to support artificial intelligence, expert system, artificial neural networks and soft computing (fuzzy logic and genetic algorithm) investigations. This lab is set up on the North Campus. It is designed to aid research in the areas of controls, sensors, embedded systems, and algorithms. The lab is built on 1,400 sq. ft. using state-of-the-art flexible automation cells donated by Nokia Mobile Phones.

Communications Laboratory

A research lab focused on communications signal processing and coding for data transmission and storage.

Digital Design Laboratories

An upper-division teaching laboratory and graduate research labs. Developments and experimentation with microprocessor control circuits, memory, and I/O functions extend the understanding of the capabilities and flexibility of this technology. A full range of PC based development platforms and instrumentation is available at each two-person team workstation. Research labs provide workstation support for hardware design languages and programmable logic implementation. This lab features teamwork areas to support capstone industry-sponsored projects.

Digital Signal Processing Lab

A research laboratory focused on DSP research issues in multimedia systems and telecommunications: representation, recognition, compression, and enhancement.

Microelectronics Laboratory

A research laboratory equipped to grow and characterize narrow band gap semiconductor materials, fabricate mid-infrared optoelectronic devices, and perform real-time in situ measurements of semiconductor manufacturing procedures. Laboratory facilities include molecular beam epitaxy (MBE) and liquid phase epitaxy (LPE) growth systems, Fourier transform infrared (FTIR) and mid-IR laser spectrometers, and a variety of computer controlled cryogenic test stations.

Radar Innovations Lab (RIL)

A lab that supports the scientific and educational goals of the Atmospheric Radar Research Center through the design and fast prototyping of innovative hardware and software systems. The RIL has state-of-art test equipment covering the DC to 50 GHz frequency range. Important radar hardware design courses have recently been added to the Weather Radar Curriculum at OU and the RIL will be used in our commitment to provide students a comprehensive education in the field of radar.

Undergraduate Laboratory for Weather Radar Signal Processing

A multi-use state-of-the-art teaching laboratory for digital signal and image processing and distributed and parallel computing. Students design and implement multimedia and communications software using multiple DSP microprocessors and PC hosts.

Scholarships and Financial Aid

UNDERGRADUATE STUDENT SUPPORT

The school annually awards many scholarships to students with superior records to help defray the cost of their education. These scholarships are awarded on the basis of merit and need. Awards range from $200 to $3,500 per year. Scholarship applications can be obtained by writing to the Coordinator of the School of Electrical and Computer Engineering, calling (405) 325-4721, e-mail ece@ou.edu, or by visiting the ECE web page at ece.ou.edu and click on the Scholarship link under undergraduate programs. The scholarship application deadline is March 15 for the subsequent academic year.

The School of Electrical and Computer Engineering works closely with Career Services to develop opportunities for internships and for
cooperative education (Co-Op) programs. Internships with industries throughout the central U.S. are available to qualified students sophomore through senior level. Co-Op activities allow students to alternate working semesters with scholastic semesters throughout their upper-division tenure.

**GRADUATE STUDENT SUPPORT**

Financial assistance to qualified graduate students is available from the School of Electrical and Computer Engineering and from other sources. The School awards scholarships, graduate teaching assistantships, and research assistantships. Students desiring financial assistance are encouraged to contact the Graduate Program Assistant of the School of Electrical and Computer Engineering and complete an application. During the month of February each year, an online RA/TA/scholarship application is available and announced on the ECE homepage for awards and appointments that will be determined for the following academic year. Requests can be sent by e-mail to: ece@ou.edu.

Awards range from $9,600 to $28,800 per year for half-time (20 hours per week) appointments. Half-time research and teaching assistantships include waiver of out-of-state tuition and waiver of six hours of in-state tuition. Students must enroll in six credit hours per semester to qualify.

**Undergraduate Study**

Students enrolled in the School of Electrical and Computer Engineering (ECE) are offered a choice of Bachelors of Science degrees in computer engineering (CpE) and electrical engineering (EE). Qualified CpE students may choose accelerated program tracks leading to an MSECE or MS in Computer Science. Accelerated program students complete their MS degrees with an accumulated 12 credit hours less than normally required to obtain both degrees. Curricula are designed to give a thorough understanding of the physical principals, the design process and the current technology in the student’s chosen discipline. Electrical engineering (EE) conventionally specializes in communications, electric power systems, microwave and rf systems, solid state electronic devices and electronics. Computer engineering (CpE) specialties include instrumentation and control systems, digital signal and image processing, and advanced computer architecture. Students are offered professional courses intended to broaden the understanding of the non-technical considerations of a successful engineering design. The objective of the programs is to prepare the student to make valuable job contributions immediately upon graduation.

Electrical and Computer Engineering professions have many facets. An extremely wide range of interesting and satisfying careers is presented to the well-qualified graduate. Some of the fields opened by this background lead to research, management, sales, and manufacturing development. Technical areas include the design, manufacture and utilization of computers, power systems, communications, automatic control systems, electronics, semiconductor devices, quantum electronics, microwave systems, instrumentation, digital signal and image processing, system instrumentation and biomedical electronics.

**CURRICULUM IN ELECTRICAL ENGINEERING**

(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

**PROGRAM OBJECTIVES**

The Program Objectives of the School are to produce engineering graduates:

- Who are capable of creative thinking;
- Who are able to advance their knowledge through research, and
- Who can contribute to economic growth through technology.

**PROGRAM OUTCOMES**

The School has selected five specific Academic Outcomes that provide overarching guidance to curriculum decisions, to produce graduates who:

- Have a solid foundation in mathematics and physical sciences;
- Have strong engineering problem solving abilities;
- Are prepared for graduate school and/or a career in industry;
- Can communicate effectively; and
- Can work in teams.

This program requires a minimum of 126 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engindx.htm.

The accelerated degree leading to a BS in Computer Engineering and an MS in Electrical and Computer Engineering, requires a minimum 3.25 OU and Combined retention GPA for program admission. The program requires a minimum completion of 144-147 credit hours with a minimum graduation grade point average of 3.0 (combined and at OU, in the major, curriculum and overall). ECE elective requirements are different from the standard program. For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engindx.htm.

The accelerated degree leading to a BS in Computer Engineering and an MS in Computer Science, requires a minimum 3.5 OU and Combined retention GPA for program admission. The program requires a minimum completion of 144-147 credit hours with a minimum graduation grade point average of 3.25 (combined and at OU, in the major, curriculum and overall). ECE elective requirements are different from the standard and accelerated program with a master’s component in Electrical and Computer Engineering. For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engindx.htm.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

**CURRICULUM IN COMPUTER ENGINEERING**

(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

**PROGRAM OBJECTIVES**

The Program Objectives of the School are to produce engineering graduates:

- Who are capable of creative thinking;
- Who are able to advance their knowledge through research, and
- Who can contribute to economic growth through technology.

**PROGRAM OUTCOMES**

The School has selected five specific Academic Outcomes that provide overarching guidance to curriculum decisions, to produce graduates who:

- Have a solid foundation in mathematics and physical sciences;
- Have strong engineering problem solving abilities;
- Are prepared for graduate school and/or a career in industry;
- Can communicate effectively; and
- Can work in teams.

This program requires a minimum of 126 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engindx.htm.

The accelerated degree leading to a BS in Computer Engineering and an MS in Electrical and Computer Engineering, requires a minimum 3.25 OU and Combined retention GPA for program admission. The program requires a minimum completion of 144-147 credit hours with a minimum graduation grade point average of 3.0 (combined and at OU, in the major, curriculum and overall). ECE elective requirements are different from the standard program. For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engindx.htm.

The accelerated degree leading to a BS in Computer Engineering and an MS in Computer Science, requires a minimum 3.5 OU and Combined retention GPA for program admission. The program requires a minimum completion of 144-147 credit hours with a minimum graduation grade point average of 3.25 (combined and at OU, in the major, curriculum and overall). ECE elective requirements are different from the standard and accelerated program with a master’s component in Electrical and Computer Engineering. For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engindx.htm.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).
Graduate Study

Areas of Specialization
The School of Electrical and Computer Engineering (ECE) offers a Masters and a Ph.D. degree in Electrical and Computer Engineering (MSECE and PhDCE). We also offer a Masters Degree in Telecommunications Engineering (MS TCOM), principally from our Tulsa campus. Current research activities in electrical and computer engineering span a variety of areas of specialization as well as a variety of interdisciplinary subjects. The research activities were detailed in earlier paragraphs of this Section.

Requirements for Admission
In addition to meeting the general requirements of the Graduate College, applications for graduate study in ECE are also evaluated with respect to additional criteria over and above the general requirements. Perspective students are expected to have previously earned a B.S. degree or its equivalent in Electrical Engineering, Computer Engineering, or a closely related field. Strong applicants holding baccalaureate degrees in other disciplines are also frequently admitted; however, in many cases such students find it helpful to enroll in some amount of undergraduate coursework to make up for field-specific deficiencies prior to attempting certain components of their formal graduate degree course requirements.

In addition, all applicants are required to submit:
1. scores for the GRE General Examination,
2. three official letters of recommendation from individuals who are well qualified to evaluate the applicant's potential for successful study at the graduate level; these letters should be submitted directly to the School of ECE by the recommenders, and
3. a statement of purpose briefly outlining their plans and goals for ECE graduate study at the University of Oklahoma with relation to their broader career goals; a length of one to two typeset pages should be sufficient for most applicants.

Specific questions concerning the programs or admission requirements may be addressed to the Graduate Liaison, School of Electrical and Computer Engineering, 202 W. Boyd St., Room 219, Norman, OK 73019-1023. Prospective students are encouraged to visit the School. The School's Internet web site is http://ece.ou.edu. Inquiries concerning graduate applications should be directed to the graduate program assistant (405) 325-4721 or in care of ecegrad@ou.edu. The deadline for international applications for prospective students seeking to enter at the beginning of the fall semester is April 1.

Master of Science Degree in Electrical and Computer Engineering
Master of Science ECE degree candidates may choose to pursue the degree with either a thesis or one of two non-thesis options. Any option may be used to enter the Ph.D. program.

The MSECE thesis option in electrical and computer engineering requires a minimum of one year of full-time study. The total number of required credits is 30 semester hours. At least 12 credit hours must be ECE or C S; however 12 credit hours (not including thesis) must be in 5000-level or higher ECE coursework. Three credit hours must be taken in mathematics or physics, and at least nine credit hours must be technical electives. Graduate credit will not be allowed for any courses that are numbered below 4000 or are part of the required undergraduate electrical or computer engineering curriculum. A minimum of 12 hours of 4000-level graduate credit courses are allowed. Enrollment in six credit hours of ECE 5980, Thesis Research, is required, and the student must write a thesis and successfully defend it before an examining committee.

The MSECE non-thesis option has two tracks. Both require a minimum of 33 semester hours of coursework and at least 12 hours must be 5000-level or higher ECE coursework. The General Track requires a minimum of 18 credit hours in ECE or C S courses, subject to limitations specified above. The M.S. General Track also requires at least 12 credit hours in technical electives and the M.S. Comprehensive examination required by the Graduate College. The remaining requirements, except for Thesis Research, ECE 5980, are the same as for the thesis option. The MSECE Industrial Internship Track requires at least 15 hours in ECE or C S coursework, at least three credit hours in math or physics, and ECE 5883, Professional Project, for which a report and an oral examination will be required. Other restrictions apply as specified above.

An MSECE concentration in Electrical Energy Production and Risk Management combining electrical and computer engineering and finance, conforms to the non-thesis General Track. Twelve credit hours must be in electrical energy (power) with nine credit hours in finance courses, eight credit hours in electrical and computer engineering courses, and three credit hours in the field of mathematics or physics. Enrollment in internship hours (which counts toward the electrical energy requirement) is also required and the student must submit a written report upon completion of each internship (a maximum of two internships is allowed). Students should consult the ECE Graduate Handbook for specific degree requirements.

Doctor of Philosophy Degree in Electrical and Computer Engineering
The total number of credits required to complete the Ph.D. is 90 semester hours beyond the B.S. degree. This normally includes 30 credit hours for a doctoral dissertation. Students are allowed to transfer up to 44 credits (in accordance with the Graduate Bulletin) from a master’s degree toward the 90 hours required.

Specific requirements for the Ph.D. are set by each student’s doctoral committee in conformance with the current rules of the Graduate College. A qualifying examination is required of all students.

Successful completion of a General Examination, consisting of both written and oral parts, is required before preparation of the dissertation. The main intent of this exam is to evaluate the student’s total preparation for conducting research and successfully completing the doctoral dissertation. Within the general requirements stipulated by the Graduate College, the specific format and requirements for the General Examination are determined by the student’s doctoral committee.

Students should consult the ECE Graduate Handbook for specific degree requirements.

Professor John Fagan and student crew with Spirit III, a solar powered car prepare to participate in the World Solar Challenge held in Australia, an international competition attracting teams from corporations, research and educational institutions. (Photo by John Fagan)
The University of Oklahoma 2009-2011 General Catalog

College of Engineering

Department of Engineering

P. Simin Pulat, Chair of Undergraduate Study
112 Felgar Hall
Norman, OK 73019-1021
Phone: (405) 325-4161
FAX: (405) 325-1366

Musharraf Zaman, Chair of Graduate Study
107 Carson Engineering Center
Norman, OK 73019-1021
Phone: (405) 325-4536
FAX: (405) 325-7508
Internet: http://www.coe.ou.edu/

Faculty Roster
The general program in engineering is offered under the broad support of the College of Engineering faculty. The faculty’s responsibility for this program is exercised through an Engineering Program Committee that is charged with the day-to-day responsibility for curriculum planning and evaluation, program supervision and student advising. Inquiries regarding the undergraduate curriculum should be addressed to P. Simin Pulat, Director of Engineering Education, who serves as chair of the Engineering Program Committee. Inquiries regarding the graduate curriculum should be addressed to Musharraf Zaman, Chair of Graduate Study.

Degrees Offered
• Bachelor of Science in Engineering
• Master of Science
• Doctor of Philosophy
• Doctor of Engineering

Special Facilities and Programs
Special facilities and laboratories for the College of Engineering include: Aerospace and Mechanical Engineering-the Combustion Laboratory, the Experimental Stress and Structures Laboratory, the Fluid Mechanics Laboratory, the L.A. Comp Subsonic Wind Tunnel, the Nonlinear Mechanics Research Laboratory, and the Radiative Heat Transfer Research Laboratory. Chemical Engineering and Materials Science-the Flame Dynamics Laboratory, the Institute for Applied Surfactant Research, the Mobil Thermodynamics Laboratory, and the Fuels Laboratory. Civil Engineering and Environmental Science, the Ray Broce Asphalt Laboratory, Soil Mechanics Laboratory, Environmental Laboratories, and the Fears Structural Engineering Laboratory. Computer Science-Artificial Intelligence Lab and Parallel Processing Institute, Electrical Engineering-the Communications and Signal Processing Laboratory, the Optoelectronics Laboratory, Power Systems, and Microelectronics Lab. Industrial Engineering-the Computer Aided Manufacturing Laboratory, the Institute for Safety and Ergonomics Studies, and the Physical Simulation and Expert Systems Laboratory. Petroleum Engineering-the Halliburton Rock Mechanics Laboratory, the Mobil Thermodynamics Laboratory, the Petroleum Production Research Institute, and Petrophysics Laboratory. Engineering Dean’s Office-Center for Artificial Intelligence and the Environmental and Ground Water Institute.

Modern computing resources in support of the College of Engineering are provided by the Engineering Computing Services (ECS).

Undergraduate Study
The general program in engineering coordinates the offerings within the College of Engineering’s “core” curriculum engineering science courses and several advanced elective courses that either are required or widely elected by students in more than one of the departmental curricula.

Graduate Study

General Information
The graduate programs in the Department of Engineering provide broad interdisciplinary programs for students who wish to pursue graduate study in preparation for careers in advanced engineering or related science areas. The Doctor of Philosophy engineering program emphasizes research; and the Doctor of Engineering program emphasizes application of engineering and scientific principles to synthesis and design of engineering systems. The engineering graduate programs are extraordinary in that they are founded upon all faculties and disciplines of engineering and science. This interdisciplinary feature offers advantages over traditional programs. The student is encouraged to develop his/her program of study and research under a specially selected Graduate Advisory Committee which will include those professors best qualified to direct and support his/her activities. This is done by selecting a faculty committee to work directly with the student.

Admission Requirements
A student who is admissible to the Graduate College and who holds a degree of Bachelor of Science in an engineering field conferred by the University of Oklahoma, or an equivalent degree, will be admitted to full-time graduate work in engineering, if the student’s academic record is above average. Degree holders from other disciplines will be expected to complete makeup work.

Engineering Master of Science
The Master of Science program in engineering allows study in interdisciplinary areas. Each applicant’s course of study is tailored to meet the student’s individual objectives.

Doctoral Programs in Engineering
Two different doctoral programs in engineering are offered, Doctor of Philosophy and Doctor of Engineering. The Doctor of Engineering degree is specifically designed for those students with several years of experience in engineering practice beyond the undergraduate degree who wish to extend the scope of their formal training.

The doctoral programs in Engineering at the University of Oklahoma offer flexibility. Each applicant’s course of study is tailored to meet individual objectives.

DOCTOR OF PHILOSOPHY
The Doctor of Philosophy degree program is concerned with the expansion of professional knowledge in the fundamental concepts of engineering and science. The doctoral student is required to produce a research dissertation of professional significance. Ninety semester hours of graduate-level coursework beyond a B.S. degree are required plus a qualifying examination, a general examination, proficiency in a research skill and an acceptable dissertation. The Ph.D. degree prepares a student for a career in teaching, research and consulting.

DOCTOR OF ENGINEERING
The Doctor of Engineering degree program provides an emphasis on coursework with a dissertation which addresses the application of engineering and scientific concepts. It is not an analytical research degree. Admission to the D.Engr. program requires a minimum of three years of acceptable engineering experience plus an engineering master’s degree. Ninety semester hours of graduate-level coursework beyond a B.S. degree are required in addition to a qualifying examination, a general examination, proficiency in a research skill and an acceptable dissertation.
Program in Engineering Physics

Michael Santos, Chair and Graduate Liaison
100 Nielsen Hall
Norman, OK 73019-2061
Phone: (405) 325-3961
FAX: (405) 325-7557
Internet: http://www.nhn.ou.edu/ephys/

Faculty Roster
Professors (of Physics) Doezema, Furneaux, Gutierrez, Johnson, Santos, Skubic; Associate Professors (of Physics) Abbott, E. Abraham, Mason, Murphy, S. Ryan, Shafer-Ray, Strauss; Assistant Professors (of Physics) Bumm, Shaffer; and participating faculty from the College of Engineering units.

Degrees Offered
• Bachelor of Science in Engineering Physics
• Master of Science
• Doctor of Philosophy

General Information
Established in 1924, the Program in Engineering Physics was one of the first programs of its kind offered in the United States. The undergraduate curriculum is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone: (410)347-7700. Throughout its history, Engineering Physics has served as the starting point for new programs in applied physics at OU. For example, geophysics, nuclear engineering, and meteorology were first offered at OU in 1935, 1955, and 1957, respectively, as options in Engineering Physics. Current research emphases in Engineering Physics include nanotechnology and cold atom science.

An engineering physicist applies the knowledge of engineering and physics to develop new engineering methods and principles; and designs, develops and supervises the construction of new equipment. The engineering physicist completes the link between the pure scientist and the engineer by being able to understand the theory of science and to relate it to the practical problems of engineering.

The program makes use of the extensive teaching and research facilities of both the College of Engineering and the Homer L. Dodge Department of Physics and Astronomy (which is part of the College of Arts and Sciences). The student to faculty ratio in Engineering Physics is excellent, with 50 majors in 2008 academic year. About one third of the graduating seniors immediately attend graduate school in physics or engineering. The recent graduates who immediately enter the work force are employed predominantly in the microelectronics or aerospace industries.

Programs for Academic Excellence
The program in Engineering Physics prepares students for careers in areas of technology where the disciplines of physics and engineering intersect. The program provides an interdisciplinary environment where pure and applied sciences merge. The curriculum is designed to develop sufficient depth in both engineering skills and physics knowledge to produce engineers who are able to relate fundamental physical principles to practical problems in engineering. In order to prepare students for careers in interdisciplinary areas of physics and engineering, the Engineering Physics program pursues the following objectives (which are discussed in detail at www.nhn.ou.edu/ephys):

• For successful careers in interdisciplinary areas of physics and engineering, Engineering Physics graduates will have an in-depth knowledge of physics equal to that of physics graduates.

• For successful careers in interdisciplinary areas of physics and engineering, Engineering Physics graduates will have a fundamental knowledge of engineering applications of modern physics. Moreover, with their knowledge of physics, they will be able to pursue and contribute to new fields as they are created.

• Engineering Physics graduates will have experience with laboratory instrumentation, have well-developed communication skills, work well in teams, and be skilled in other practical areas that are important for practicing engineers and scientists.

An essential facet of an Engineering Physics education is research experience. This provides students with the opportunity to use modern engineering tools to address open issues in science and technology. Many students participate in research even before starting their senior Capstone project. All students are encouraged to apply for a position in a National Science Foundation-Research Experience for Undergraduates (NSF-REU) program as soon as they are qualified. Many students take part in the Department’s NSF-REU program for one summer during their academic career. These research experiences provide the opportunity for particularly strong interaction between a student and a faculty member. The program is also actively involved with the Honors College in an effort to offer exceptional students the opportunity to do advanced study.

Special Facilities and Programs
The Homer L. Dodge Department of Physics and Astronomy possesses an excellent scientific library of about 34,000 volumes and more than 175 journal subscriptions. Ancillary library holdings include the world-famous History of Science Collection. A well-equipped and staffed in-house machine shop is provided for use by graduate students. Excellent computing facilities include the SUN/UNIX Physics computer network and the Natural Sciences Computer Laboratory which is housed in the department.

The Department has well-equipped laboratories for research in atomic and molecular collisions, laser cooling and trapping, artificially-structured materials, nanometer-scale materials characterization, low-temperature condensed matter, and instrumentation in high-energy physics. Some of the research is performed as part of the NSF-sponsored Center for Semiconductor Physics in Nanostructures. Research groups also make use of facilities at national laboratories such as Fermilab, the LHC, Los Alamos, and the National High Magnetic Field Laboratory.

The combined curriculum from the College of Engineering and the Homer L. Dodge Department of Physics and Astronomy provides the finest quality program for both undergraduate and graduate students. The interdisciplinary structure allows students access to a wide range of research topics.

Scholarships and Financial Aid
The Department offers a number of J. Clarence Karcher Scholarships each year to students majoring in physics, astronomy, or engineering physics. In addition, one or more Roy B. Adams Engineering Physics Scholarships and a Michael L. Ruby Engineering Physics Scholarship are awarded each year. The scholarships range from $700-$2,000 per academic year and are renewable. This helps the student to be in the mainstream of his/her professional interest and at the same time receive financial assistance throughout the undergraduate years. Applications (consideration deadline March 15 for the following fall) may be obtained from Undergraduate Programs, Homer L. Dodge Department of Physics and Astronomy, Nielsen Hall, Norman, OK 73019-2061.

Teaching and research assistantships are offered on a competitive basis to graduate students. In 2008 the assistantships started at $19,000 for students with 12 months of support. The Lin Fellowship provides an additional stipend for the first two years of graduate study while the Homer L. Dodge Graduate Fellowship provides an annual stipend of $25,000 with no teaching assistantship responsibilities for the first two years. Departmental applications for graduate study and financial assistance may be requested from the Graduate Programs-Physics, Nielsen Hall, Norman, OK 73019-2061.
Undergraduate Study

The undergraduate major requires 126 hours including 40 hours of physics, 33 hours of engineering and 18 hours of mathematics.

The engineering physics program offers an interdisciplinary bachelor’s degree which combines the course offerings and research activities of the College of Engineering and the Homer L. Dodge Department of Physics and Astronomy. The degree is recommended by the College of Engineering faculty. The curriculum includes the basic core of science, mathematics, social sciences and engineering sciences that are common to all engineering degree curricula, a block of prescribed upper-division physics courses, and a planned sequence of advanced courses in engineering, physics and allied areas that fulfills the design/synthesis requirement of an engineering program.

CURRICULUM IN ENGINEERING PHYSICS

This program requires a minimum of 126 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrnidx.htm.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

Graduate Study

Areas of Specialization

(Partial list only) growth and characterization of electronic and optical materials, device fabrication and simulation, laser applications in chemical reaction dynamics, laser cooling and trapping, microelectronic applications in particle physics.

Prerequisites for Full Graduate Standing

In addition to meeting the general requirements of the Graduate College, the student should have a Bachelor of Science in Engineering Physics or an equivalent degree with a minimum preparation of 30 hours of physics and 15 hours of engineering.

Master of Science

This degree is offered as either a nonthesis program or as a thesis program. The nonthesis program requires satisfactory completion of 32 hours of graduate study comprising a minimum of 12 hours of physics and 12 hours of engineering courses. Students must take and pass the physics qualifying examination. The thesis program requires completion of 30 hours of graduate credit including a research thesis on some topic of applied science. Students may count up to four credit hours of thesis research as part of their program. If the thesis supervisor is from engineering, a minimum of 12 hours of physics and nine hours of engineering is required; if the thesis supervisor is from physics, a minimum of nine hours of physics and 12 hours of engineering is required.

All programs of study must be approved by the engineering physics chair or a duly appointed representative. All students of either program must include at least one three-credit-hour mathematics course numbered 4000 or higher. Graduate credit will not be allowed for any course equivalent to one required in the undergraduate engineering physics program.

Doctor of Philosophy

Students electing to study for a doctoral degree are referred to the general requirements of the Graduate College and the College of Engineering. Each student is assigned an advisory committee who will determine the specific requirements within the guidelines set by these colleges.

School of Industrial Engineering

Randa L. Shehab, Director
Mary C. Court, Undergraduate Liaison
Scott Moses, Graduate Liaison
124 Carson Engineering Center
Norman, OK 73019-1022
Phone: (405) 325-3721
FAX: (405) 325-7555
Internet: http://ie.ou.edu

Faculty Roster

Professors Grant, Kumin, Landers, S. Pulat, Raman, Schlegel, Shehab, Traftal; Associate Professors Court, Karabuk, Moses; Assistant Professors Guan, Ling, Starly; Instructors Barker, Wolfinbarger; Adjunct Professors Genheimer, Hartmann, M. Pulat, Rogers, Swim; Professors Emeritus Foote, Purswell.

Degrees Offered

• Bachelor of Science in Industrial Engineering
• Bachelor of Science in Industrial Engineering: Information Technology Option
• Bachelor of Science in Industrial Engineering: Pre-Medicine Option
• Accelerated Bachelor of Science in Industrial Engineering/Master of Science (Industrial Engineering)
• Accelerated Bachelor of Science in Industrial Engineering: Information Technology/Master of Science (Industrial Engineering)
• Accelerated Bachelor of Science in Industrial Engineering/Master of Business Administration
• Master of Science
• Doctor of Philosophy

General Information

The most versatile engineering discipline, industrial engineering opens doors for careers in business, health care, consulting, government, and manufacturing. Industrial engineers are improvement engineers. IEs help companies add value by eliminating waste and using resources effectively. Industrial engineers are integration engineers. IEs bring people, processes, machines, and technologies together to solve complex problems in all types of organizations. Industrial engineers are information engineers. IEs use computer-based tools to collect data, organize and analyze information, and present solutions. Industrial engineers are innovation engineers. IEs use a total systems approach, combining engineering expertise with a business perspective, to solve modern problems on a global scale.

Industrial engineers improve, integrate, inform, and innovate.

As businesses of all types strive for improvement in quality and productivity, they increasingly turn to industrial engineers. Industrial engineers (IEs) design, analyze, and improve systems and processes for all types of businesses. Although many IEs work in manufacturing, others work in service industries, wholesaling, retailing, research, law, government, and healthcare. They work to integrate systems involving people, materials, facilities, finances, equipment, and energy to achieve the best possible results. The ability to improve systems provides a broad range of applications ranging from applying lean concepts to manufacturing to minimizing waiting time at amusement parks. The ability to see the big picture, identify and solve problems, and facilitate change to improve systems helps IEs move up faster in the corporate ladder than any other engineering discipline.
Our faculty members are internationally recognized as experts in all aspects of industrial engineering and are active in professional research and practice. They hold doctorates from Arizona State, Case Western Reserve, Drexel, Georgia Tech, Lehigh, North Carolina State, Oklahoma, Penn State, Pittsburgh, Purdue, Rensselaer, and Texas Tech. The faculty also possess diverse industrial experience.

Our students have received numerous awards, including the Halliburton and the National Science Foundation Fellowships and national scholarships through the Institute of Industrial Engineers. Several faculty members have reached the “Fellow” level of professional societies. Our school is recognized throughout the University for its collegiality and friendly and supportive atmosphere.

The School’s undergraduate curriculum options recognize the broad nature of the industrial engineering profession. The regular IE option prepares students for traditional industrial engineering jobs by providing a strong, broad-based, core curriculum. The information technology option allows students to take several computer science courses in addition to the IE core and prepares them for jobs where the use of information technology is critical to company operations. The pre-medicine option prepares students for jobs in the health care industry by providing core IE skills to define, analyze, and improve patient care practices. The students also complete the required coursework for pre-medicine.

The School has several programs of graduate study. We offer two tracks for students pursuing a Master’s of Science degree (thesis and Engineering Management) and we offer a Doctor of Philosophy degree program. For our undergraduate students interested in advanced degrees, both the regular and information technology BS options can be combined with a Master of Science in IE through accelerated BS/MS degrees. The School has also partnered with the Michael F. Price College of Business, to offer a cross-college accelerated track for the Bachelor of Science in IE/Master of Business Administration degree. Our graduate program is nationally ranked by U.S. News and World Report.

Special Facilities and Programs

The School of Industrial Engineering faculty serve in leadership positions in several school, college and university-affiliated research centers, including the Center for the Study for Wireless Electromagnetic Compatibility (EMC), the Center for Engineering Logistics and Distribution, the Center for the Study of Human Operator Performance, the Research Institute for STEM Education, and the Oklahoma Transportation Center.

CENTER FOR ENGINEERING LOGISTICS AND DISTRIBUTION (CELDi)

CELDi is a multi-university, multi-disciplinary National Science Foundation sponsored Industry/University Cooperative Research Center (I/UCRC). Research endeavors are driven and sponsored by representatives from a broad range of member organizations, including manufacturing, maintenance, distribution, transportation, information technology, and consulting. CELDi provides integrated solutions to logistics problems through research related to modeling, analysis and intelligent-systems technologies.

CENTER FOR THE STUDY OF HUMAN OPERATOR PERFORMANCE (C-SHOP)

C-SHOP is a multi-disciplinary research center at the University of Oklahoma that focuses on the development and application of computer-based tests for assessing human performance across a broad range of military, industrial, educational, and medical applications. C-SHOP is one of the nation’s premier sites for developing advanced computerized testing technology and for conducting research exploring the limits of human cognitive and neuropsychological function. (http://www.c-shop.ou.edu/)

OKLAHOMA TRANSPORTATION CENTER (OTC)

The OTC is a multidisciplinary coalition of the Oklahoma State University, the University of Oklahoma and Langston University to serve as a resource for solving critical transportation problems in the state and in the nation in a cooperative manner. The OTC has over 30 founding partners including the Oklahoma Department of Transportation, Oklahoma Transportation Authority, and companies and associations representing all transportation modes. Since its inception, the OTC faculty and students have worked collaboratively on different projects covering a broad spectrum of topics, including improving work zone safety through remote monitoring, modeling statewide freight movement, developing a computerized accident analysis system, analyzing impacts of highway construction, and implementing emerging technologies for structural health monitoring and material testing.

THE RESEARCH INSTITUTE FOR STEM EDUCATION (RISE)

The Research Institute for STEM Education brings together a multi-disciplinary research team whose mission is to study the complex array of factors contributing to diverse student’s academic experiences in science, technology, engineering, and mathematics majors (STEM) and to make recommendations to academic policy makers based on those factors.

THE WIRELESS EMC CENTER

The Wireless EMC Center studies interference issues between wireless communication and other electronic devices and is the only such research center in the United States. The EMC Center performed the premier study on the interaction between implantable pacemakers and wireless phones. The Center is a leading organization in the total systems approach to integrating electrical engineering technology and industrial engineering systems study and optimization to yield solutions for interaction problems. Funding comes from a consortium of industries and the National Science Foundation. Graduate research assistantships are available for interested students. (http://www.ou.edu/engineering/emc)

Teaching and Research Laboratories

In addition to the active research centers, the School houses several laboratories for teaching and research in advanced systems modeling, data mining, ergonomics, manufacturing, optimization, quality engineering, and simulation. Undergraduate research assistantships work in these labs on externally funded research projects.

CARROLL G. WEBB IE TEAM ROOM

The Carroll G. Webb IE Team Room is a room dedicated to collaborative and individual study by IE students. The room provides a comfortable environment for team work with conference tables, a computer projection system, desktop computers, and a small seating area for group conversation.
COGNITIVE ASSESSMENT AND SYSTEM ENGINEERING (CASE) LAB

The Cognitive Assessment and System Engineering (CASE) Lab conducts research on the design and assessment of interfaces, information technology products, and complex human-machine systems based on human information processing capabilities and limitations. On-going research projects include information complexity analysis of Air Traffic Control (ATC) displays, usability evaluation of mobile device displays, and E-Commerce websites studies. This lab also serves as a teaching lab and a data collection facility for human performance data.

ENVIRONMENTAL WORK PHYSIOLOGY LAB

This lab houses the environmental chamber that provides control of the physical thermal environment (temperature and humidity). This chamber is used to simulate a variety of working conditions for various course lab exercises and research experiments. This lab also contains equipment for the measurement of physiological variables (heart rate, blood pressure, body temperature), environmental variables (sound, vibration, light, temperature, and humidity), metabolic workloads (programmable treadmill and a programmable cycle ergometer), and psychomotor performance (reaction time, manual dexterity, eye-hand coordination, and tracking).

INSTRUCTIONAL COMPUTATION LAB

This lab contains several PCs, a printer, and software for IE students. The lab contains dedicated IE software that is used in many upper-level and graduate courses.

LABORATORY FOR ENGINEERING LIVING TISSUE SYSTEMS

This lab supports activities in the design, analysis and fabrication of three-dimensional (3-D) tissue constructs for applications in tissue engineering, regenerative medicine, and drug screening studies. This research lab features advanced CAD/CAE software, in-house developed algorithms, fiber optic biosensors, hybrid bio-manufacturing equipment (UV Photopolymerization, Droplet Deposition, Electro-Spinning) in an attempt to create better and efficient designs of tissue scaffolds/constructs.

LOGISTICS AND COMPUTATIONAL OPTIMIZATION LAB

The lab supports broad interests in applying operations research methods to transportation and logistics, production planning, telecommunication network pricing as well as medicine and health care. The lab also supports the development of decision support systems. Currently research focuses on specific logistics problems such as inventory control under data inaccuracy and secure container flow efficiency analysis. Printers, software and computers are available in the lab.

MACHINING AND PRECISION LAB I

Manufacturing process equipment housed in this lab, for teaching and research purposes, include a research engine lathe for friction and wear studies, a 3-axis CNC milling machine, a CNC 3-axis miniature milling machine, three coordinate measurement machines (one CNC and two manual), an optical projector, a micro-computer based data acquisition system (including piezoelectric tool force dynamometer with amplifiers), a high-resolution data acquisition system with card/box for isothermal compensation (cold junction), amplification, linearization, calibration, and A/D conversion, and acoustic emission measurement equipment.

MOTION ANALYSIS LAB

Used both for undergraduate and graduate teaching and research, this lab houses a video-based motion analysis system, consisting of video equipment and computer hardware and software to support data collection and analysis. This lab adjoins the Physical Performance Lab through a set of double doors to provide additional space to accommodate the requirements of videotaping human motion.

PHYSICAL PERFORMANCE LAB

The lab is used for undergraduate and graduate teaching and research. It supports anthropometric and human strength measurement as related to industrial ergonomics and product design. Equipment includes a computer-based system for collecting various strength measurement data, as well as the necessary hardware (e.g., strain gauges, analog-to-digital converters, and posture support mechanisms) to aid such data collection; apparatus to enable manual-material handling studies; an electrogoniometer and a complete anthropometric measurement set. A computer equipped with the Statistical Analysis System (SAS) is also available for students to use in data analysis.

PRECISION ENGINEERING LAB II

Used both for undergraduate and graduate teaching and research in manufacturing engineering, the equipment in this lab includes a complete machine vision system (with analog frame grabber, processing monitors, a Pentium-based PC workstation, and vision software), optical measurement accessories (lenses, linear and circular stages, laser light source), tool-maker’s microscope, a contact surface roughness profilometer, ultrasonic pulse/receiver, oscilloscope, an industrial SCARA robot, and a precision lathe modified for specimen rotation in roughness measurement experiments. Software available includes MasterCAM software.

PRODUCTION LOGISTICS LAB

The Production Logistics Laboratory serves as the primary venue for computational research activities in the areas of production systems and logistics. The lab is equipped with several high-end dual-boot Linux/Windows machines that are loaded with research tools for software development and modeling (Java JDK, Eclipse, Matlab, CPLEX, Awesim, and Arena). Laboratory facilities also are used for undergraduate and graduate level course projects. Students completing course projects have access to commercially marketed supply chain management software (i2 Technologies).

SIMULATION ANALYSIS AND STOCHASTIC SYSTEMS IN IE (SASSIE) LAB

Arena simulation software is used in the simulation lab to analyze systems in order to characterize and predict their behavior. One completed study targeted the development of evacuation models for aircraft. A current research project focuses on simulating large population movement during emergency evacuations.

Undergraduate Study

The School’s undergraduate curriculum is designed to achieve the following educational objectives:

1. Our alumni will have successful careers involving the development, implementation, and/or operation of integrated systems including elements such as people, technology, materials, information, equipment, and safety.

2. Our alumni will be engaged in activities of life-long learning and professional development to enhance their market competitiveness.

3. Our alumni will be engaged in activities of good stewardship and service to the profession and/or community.

The science base for industrial engineering includes mathematics and physical science. Industrial engineering is unique among engineering disciplines in that it also applies the life sciences and social sciences. This emphasis on the human element leads to systems designs that enhance the quality of life for all people, both as producers and consumers of products and services. Many industrial engineers have demonstrated the leadership qualities necessary to advance in management.

The undergraduate curriculum includes humanities, engineering sciences, and industrial engineering courses. The IE plan of study includes tool-oriented courses such as design and manufacturing processes, experimental design, optimization modeling, and human factors. A sequence of courses is
problem-oriented and provides the student with perspective and experience in systems integration. These courses also provide opportunities to work on project teams in laboratory research and in actual industrial settings. Included in this group of courses are facilities planning and design, production planning and control, research techniques of ergonomics, and senior design project. The IE curriculum also prepares the graduate to pursue registration as a Professional Engineer. The learning experience is broad, preparing the graduate for a professional career or to continue toward a master’s degree in Industrial Engineering. Alternatively, the graduate may pursue other professions through MBA, medical, or law school.

Curriculum in Industrial Engineering

BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING

(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

This program requires a minimum of 124 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

All College of Engineering students are required to make a C in each prerequisite course before progressing to the next course(s).

INFORMATION TECHNOLOGY OPTION

(Accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.)

This program requires a minimum of 131 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

PRE-MEDICINE OPTION

This program requires a minimum of 136 credit hours with a minimum grade point average of 2.0 (combined and at OU, in the major, curriculum and overall). For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

ACCELERATED B.S. IN INDUSTRIAL ENGINEERING/MASTER OF BUSINESS ADMINISTRATION

This program requires 156 credit hours with a minimum grade point average of 3.0 (combined and at OU, in the major, curriculum and overall). Application is open only to Industrial Engineering juniors with a minimum grade point average of 3.0. The students must take GMAT during their junior year and be admitted to the MBA program. For detailed semester by semester curriculum requirements, contact the School of Industrial Engineering.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

All IE/MBA students are required to maintain their GPA at or above a 3.0 each semester. A GPA below 3.0 will result in immediate dismissal from the MBA portion of the program.

ACCELERATED B.S. IN INDUSTRIAL ENGINEERING/MASTER OF SCIENCE

This program requires a minimum of 142 credit hours with a minimum grade point average of 3.0 (combined and at OU, in the major, curriculum and overall). The program is only for students majoring in Industrial Engineering at the University of Oklahoma. Application is open only to Industrial Engineering juniors with a minimum grade point average of 3.25. For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

ACCELERATED B.S. IN INDUSTRIAL ENGINEERING: INFORMATION TECHNOLOGY/MASTER OF SCIENCE

This program requires a minimum of 155 credit hours with a minimum grade point average of 3.00 (combined and at OU, in the major, curriculum and overall) in the undergraduate program and a minimum of 3.25 in the graduate program. Students must meet the same curricular and 2.80 grade point average requirements as computer science students prior to taking upper-division computer science courses. For detailed semester by semester curriculum requirements, please consult: http://checksheets.ou.edu/engrindx.htm.

All College of Engineering students are required to make a minimum grade of C in each course presented for the degree. Also, students must make a C in each prerequisite course before progressing to the next course(s).

Graduate Study

Areas of Specialization

COMPUTATIONAL OPTIMIZATION

Research in computational optimization includes large-scale discrete and continuous optimization problems, focusing on optimization under uncertainty, robust optimization, and interior point methods. Research includes fundamental methodological investigations as well as applications in manufacturing, production and workforce planning, power scheduling, terminal operations, evacuation planning, weather prediction, financial engineering, and genetics.

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Researchers in the logistics and supply chain management area develop models and algorithms that solve complex logistics problems within a supply chain (such as inventory accuracy analysis, fleet routing, berth allocation), as well as coordinate functions and stages across single- or multiple-industry supply chains.

HUMAN FACTORS

Ongoing human factors research programs deal with the evaluation of human performance in applied environments, including air traffic control, astronauts, and deployed soldiers, with emphases on cognitive performance assessment and human-computer interaction. Research also examines issues associated with performance of special populations, particularly gait analysis of elderly and disabled adults.

MANUFACTURING

Main areas of interest in manufacturing research focus on process tribology and shape engineering. Tribology research examines new techniques, including adaptive sensing, tolerances, process planning, fixtureing, and NC path planning, to characterize and measure surfaces. Shape engineering research deals with the creation of repair or replacement parts by rediscovering principles of the device or system’s operation and includes aerospace and biomedical applications.

SIMULATION AND STOCHASTIC MODELING

Our researchers in simulation and stochastic processes are interested in fundamental research and applications of simulation models and stochastic systems. Particular focus areas include the development of domain specific simulation languages, statistical analysis of simulation outputs, design of queueing systems, and computational results of system models.
ENGINEERING EDUCATION

Engineering education research in the School of Industrial Engineering deals with enhancing our understanding of student success in engineering through studies addressing pedagogical issues, student learning, and issues relevant to recruitment, retention, and graduation of a diverse student population.

Prerequisites for Full Graduate Standing

Students with undergraduate degrees in engineering, the physical sciences, mathematics, computer science, statistics, industrial management or psychology are eligible to apply for admission. Graduates of accredited programs in industrial engineering are usually accepted for advanced study without prerequisite coursework. Graduates of programs in other fields may be required to take undergraduate courses in industrial engineering and related areas to remove deficiencies in their background. An official GRE Score must be submitted to the School.

Master of Science (Thesis Option)

The Master of Science degree with thesis option is recommended for student’s desiring a sound fundamental knowledge of Industrial Engineering with some degree of specialization. The Master of Science degree requires at least 30 credit hours, including six credit hours for the thesis. For the remaining 24 hours, a student must select at least 15 hours of industrial engineering courses including at least one advanced course from three of the following areas: human factors engineering, production and manufacturing systems, operations research and statistical analysis. The thesis is to be defended in a final oral examination. Up to nine hours of non-industrial engineering electives, which must be approved by the graduate committee, and which are not required for the industrial engineering undergraduate degree, may be used for the degree. No 3000-level courses and no more than six hours of 4000-level courses with graduate credit can be counted toward the Master of Science degree.

Master of Science (Engineering Management Non-Thesis Option)

The Engineering Management program enables students to learn advanced IE techniques and provides students the opportunity to study management practices and advanced business skills. This option is restricted to those students who have an undergraduate degree in engineering.

A student must take at least 34 hours of coursework. Students learn advanced industrial engineering techniques in 24 hours of coursework, which include twelve hours of industrial engineering core and six hours of industrial engineering electives.

Students gain exposure to graduate level topics in business administration in 10 hours of coursework: two 2-hour courses in accounting, and three 2-hour courses from one of three available emphasis areas (management information systems, supply chain management, and finance). A final comprehensive examination must be passed before graduation.

Doctor of Philosophy

The Doctor of Philosophy degree prepares the student to perform cutting-edge research in an area of study within the profession of Industrial Engineering. A qualifying examination will be given to the doctoral student within the first 18 hours of coursework. After the student successfully completes the qualifying examination, an advisory conference will be held prior to enrollment for the following semester. The purpose of this conference is to establish the candidate’s formal plan of study. At least 18 credit hours of coursework must be taken at OU, with at least 12 of these credit hours being in 5000-level or above industrial engineering courses.

No more than 42 credit hours of doctoral dissertation (6980) are allowed. The doctoral student’s plan of study should include at least one graduate-level course from two of the four following areas: human factors/ergonomics, operations research, production and manufacturing, and statistical analysis. Following the completion of coursework, the student must successfully pass a comprehensive general examination. Successful completion of the general examination will admit the student to the full doctoral candidacy. More detailed information on the doctoral program may be obtained by writing to the director of the School.

Exploration and research into renewable energy sources is an ongoing hand-in project for students in the College of Engineering. Whether it be electric or solar power, student teams work on developing alternative energy source vehicles. (Photos by John Fagan)