College of Engineering, Architecture and Technology

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Engineers, engineering technologists, and architects, working side by side, constitute one of the most powerful agents for change in our society. New ways are found to control the environment, to utilize the resources and forces of nature and to increase productivity of needed goods and services, in short, to improve the quality of life for all.

Most of the work of engineers, technologists and architects is concerned with the conception, design, fabrication, maintenance and testing of devices, processes, installations, and systems that serve human needs. This work provides ample opportunity to express creativity. It requires an ability to make decisions.

The professionals and semi-professionals who will be largely responsible for the shape of the world in the next few decades include those now in higher education. The power they will exercise makes an exciting prospect and presents a sobering responsibility. The easy problems are usually solved first and are now a part of history. Many difficult problems remain. The need for talented and highly trained people is obvious; one will be embarking on a lifetime of challenge if he or she decides to prepare for a career in engineering, engineering technology or architecture at Oklahoma State University.

The College of Engineering, Architecture and Technology (CEAT) offers a complete spectrum of educational opportunities designed to give graduates the capability and the flexibility to meet the ever-changing requirements of society—a society heavily committed to technological innovation. To be prepared to make continuing contributions, engineers, architects and technologists must have at their command not only the modern tools and processes of industry, but a firm and rigorous education in mathematics, the physical sciences, analysis and design. In order that those contributions be sensitive to genuine human needs, the engineer, architect or technologist must also be schooled in the social sciences and humanities that provide the understanding of non-technical factors that must shape technological innovation and implementation. The study of social sciences and humanities also helps prepare the graduate to be an effective contributor within human organizations. With this firm foundation and a commitment to lifelong learning, graduates make contributions to society throughout their professional careers.

The curricula in each of the programs seek to provide the optimum combination of breadth in the enduring fundamentals that undergird technologically based society, and specialization in the branch or discipline in order to equip the student to contribute to solutions at the cutting edge of the science or technology involved. Curricula are continuously evolving to include current applications of the principles. With such a bridge between theory and practice, the educational experience should support one's following diverse interests and opportunities throughout the productive years of his or her life span.

Academic Programs

Academic programs offered in the College of Engineering, Architecture and Technology culminate in the following degrees:

Schools of Engineering:

Bachelor of Science in Aerospace Engineering, Biosystems Engineering with options in agricultural, biomechanical, environmental and natural resources, and food and bioprocessing; Chemical Engineering with options in environmental, biomedical, and premedical; Civil Engineering with an environmental option; Electrical Engineering with a computer engineering emphasis area; Industrial Engineering and Management; and Mechanical Engineering with an option in premedical.

Master of Manufacturing Systems Engineering.

Master of Science in biosystems engineering, chemical engineering, civil engineering, control systems engineering, electrical engineering, engineering and technology management, environmental engineering, industrial engineering and management, and mechanical engineering.

Doctor of Philosophy in biosystems engineering, chemical engineering, civil engineering, electrical engineering, industrial engineering and management, and mechanical engineering.

School of Architecture:

Bachelor of Architecture, Bachelor of Architectural Engineering, Master of Architecture and Master of Architectural Engineering.

Division of Engineering Technology:

Bachelor of Science in Engineering Technology with programs in construction management technology (options in building and heavy), electrical engineering technology (option in computer), fire protection and safety technology, and mechanical engineering technology.

Accreditation

Undergraduate engineering programs are separately accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC of ABET). More information on this accreditation is available from the Accreditation Director, Engineering Accreditation Commission, Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202; phone: (410) 347-7700; electronic mail: *accreditation@abet.org*. Specifics of

accreditation are found in the sections devoted to each program on the following pages.

The Bachelor of Architecture program is accredited by the National Architectural Accrediting Board. More information on this accreditation is available from the Accreditation Director, National Architectural Accrediting Board, 1735 New York Ave. NW., Washington D.C. 20006.

The undergraduate engineering technology programs are separately accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET). For information on this accreditation, contact the Accreditation Director, Engineering Technology Accreditation Commission, Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202; phone: (410) 347-7700; electronic mail: *accreditation@abet.org*. Specifics of accreditation are found in the program descriptions in the section "Division of Engineering Technology."

Special College Programs

Cooperative Education. The Cooperative Education program provides students work opportunities in a supervised environment that assures professional development. Work periods alternate with academic studies. Students enter the program at the end of their sophomore year and complete at least one calendar year of supervised work experience in two or more work periods prior to graduation.

Scholars CEAT Program. This program provides developmental experiences for a select group of gifted students that will develop their technical competence, world view, professional and public responsibility, and leadership skills. About 25 students are selected by application each year and interview to enter this four year program, based on demonstrated academic and leadership potential. Students participate in special lectures, tours, residence hall programs, seminars, personal development activities, faculty mentoring, and summer tours in the U.S. and abroad.

CEAT Research Scholars Program. This program provides opportunities for accelerated intellectual development of a select group of students. Approximately 12 new freshmen students are identified from applications and interviews annually to participate in this four year program. Each student is assigned to a research faculty mentor, participates in a research program, travels to one or more major research facilities and participates in a national professional society meeting.

Phillips Engineering Scholars Program. The Phillips Petroleum Company sponsors this program to increase the number of outstanding graduates in engineering from Oklahoma State University. Freshman students are identified for this program from applications and interviews with both Oklahoma State University faculty and Phillips employees. The program includes a number of experiences to help students develop professionally, build leadership and teamwork skills, assess personal capabilities, achieve academic excellence, enhance interpersonal relationships, and increase the student's awareness of career opportunities. Special features include the assignment of a Phillips engineer to mentor each student, focused national and international trips and financial support.

Women in Engineering, Architecture, and Technology (WEAT). Programs and resources are in place to develop and support female enrollment in the CEAT. Peer mentoring program, an active Society of Women Engineers, summer programs in engineering for high school students, a conference for high school and OSU students, and a vigorous recruiting effort are all directed at recruitment and retention of women in engineering, architecture and technology. Female faculty and a coordinator of WEAT programs provide support to this program.

Multicultural Engineering Program. These programs are directed at increasing the number of minority graduates from the CEAT, and increasing the understanding of diverse cultures on the part of all students. Included are programs for recruitment and retention of qualified minority students. Industrial support provides scholarships, summer employment, and supplemental funds for recruitment and retention of minority students. Cultural awareness programming is designed to increase understanding of and sensitivity to the diverse cultures with which students will have to interact in today's world.

Employment Service. The CEAT Career Services Office supports the University Career Services and assists students with on-campus interviews and job referrals for summer coop and permanent employment. Job vacancy listings, reference files, and resource materials on resume preparation, interviewing, and job search techniques, are available for student reference. Orientation meetings and various workshops are provided to prepare students for the process of seeking employment.

CEAT Residence Hall Program. CEAT floors have been established in the Kerr-Drummond residence hall for both men and women CEAT students. Students on these floors have access to computers, reference materials and test files. CEAT student staff live on the floors to provide programming and monitoring. Supplemental instruction is provided for selected math, science and engineering courses. Special activities are planned for the floors including events with faculty and other resource persons. This arrangement provides a community where students can study together, have access to tutoring, and serve as role models for other students. The atmosphere on these floors is conducive to study.

Departmental Clubs and Honor Societies

Alpha Epsilon (agricultural engineering honor society)

Alpha Pi Mu (industrial engineering and management honor society)

Alpha Rho Chi (architecture honor society)

Amateur Radio Club

American Indian Science and Engineering Society

American Institute of Architecture Students

American Institute of Aeronautics & Astronautics

American Institute of Chemical Engineers

American Society of Agricultural Engineers

American Society of Civil Engineers

American Society of Heating, Refrigeration and Air Conditioning Engineers

American Society of Mechanical Engineers

American Society of Safety Engineers

Architecture Engineering Institute

CEAT Student Council

Chi Epsilon (civil, architectural or general engineering honor society)

Construction Management Society

Construction Specifications Institute

CEAT Student Council

Eta Kappa Nu (electrical engineering honor society)

Fire Protection Society

Institute for Operations Research and the Management Sciences

Institute of Electrical & Electronics Engineers (two student branches)

Institute of Industrial Engineers

Omega Chi Epsilon (chemical engineering honor society)

Pi Tau Sigma (honorary mechanical engineering society)

Sigma Gamma Tau (honorary aerospace engineering society)

Society of Automotive Engineers

Society of Automotive Engineers Racing Team

Society of Automotive Engineers–CEAT Mini-Baja Team

Society of Automotive Engineers–Engineering Technology Mini-Baja Team

Society of Black Engineers, Technologists & Architects

Society of Fire Protection Engineers

Society of Hispanic Engineers

Society of Manufacturing Engineers

Society of Women Engineers

Student Association of Fire Investigators

Tau Alpha Pi (technology students honor society)

Tau Beta Pi (engineering students honor society)

CEAT Honors Program

The Honors College provides opportunities for challenges for undergraduate students of unusually high ability, motivation and initiative. Honors classes, seminars and independent study courses are structured to put interested students and teachers together in ways which encourage discussion and a mature approach to learning.

Each honors course completed with an "A" or "B" grade is identified on the student's transcript as such. A special bachelor's degree honors diploma is conferred upon graduation for successful completion of all Honors College requirements.

Qualified high school scholars are eligible for The Honors College beginning with their first enrollment at OSU as freshmen. Eligibility is based on a composite ACT score of 27-29 and a high school grade-point average of 3.75 or higher, or an ACT score of 30 or higher with a 3.50 high school grade-point average. Students other than new freshmen may enter the Honors Program if they have a cumulative grade-point average of at least 3.25. Students should contact The Honors College, 509 Edmon Low Library, for eligibility forms.

Honors Recognition. The General Honors Award is earned by completing a minimum of 21 honors credit hours with grades of "A" or "B." At least three honors credit hours must be completed in each of four of the following areas: (1) English, speech communication and foreign languages (2000 level or higher), (2) humanities, (3) mathematics, statistics and computer science, (4) natural science, (5) social science, and (6) other courses with honors credit. Three of the 21 credit hours must be in a special honors seminar or an interdisciplinary honors course. A 3.50 or higher cumulative grade-point average is required at the time of the award. Completion of the General Honors Award is noted on the student's official transcript.

The College Honors Award is earned by completing a minimum of 12 honors credit hours in upper-division courses with grades of "A" or "B." The 12 credit hours must include a senior honors thesis or senior honors project with a public presentation of the results. A 3.50 or higher cumulative grade-point average is required at the time of the award. Completion of the College Honors Award is noted on the student's official transcript.

Students who complete a minimum of 39 honors credit hours with grades of "A" or "B" and have received both the General Honors Award and the College Honors Award will be granted the bachelor's degree with honors. This recognition is reflected on the student's official transcript and on a special honors diploma.

Scholarships

Several scholarships are funded through private donations, alumni gifts, and industries, and vary in amounts from $400 to over $5,000 per year.

These scholarships are available for freshman through senior students, and are awarded primarily on the basis of academic achievement and leadership potential. However, during the selection process consideration may be given to financial need and other factors. Freshman students should normally have an ACT composite score of 29 or higher and be in the top 10 percent of their high school graduating class to be competitive for CEAT scholarships.

Each school or department within the College normally has scholarship funds available. These are administered through that school or department rather than through the College's scholarship committee. However, a separate application form is not required.

Scholarship application forms for transfer students may be obtained by contacting the Office of Student Academic Services, CEAT, 101 Engineering North, OSU, Stillwater, OK 74078.

Freshman scholarship applications should be completed and on file by February 1 preceding the academic year for which the student expects to receive the scholarship in order to assure full consideration. The OSU Freshman Fee Waiver and Scholarship form should be submitted to the Office of University Scholarships. Since copies of these applications are forwarded to CEAT, a separate application is not required.

Continuing students should submit scholarship applications to the head of the school in which they are majoring prior to May 1. In this manner they will also be considered for any departmental scholarships for which they may be eligible as well as for any CEAT scholarship. Students who have not selected a major should submit their applications to the Office of Student Academic Services.

Concurrent Enrollment

If a student expects to apply credits toward a degree at OSU that are to be earned at another institution or through correspondence or extension, while enrolled in one of the programs of the College of Engineering, Architecture and Technology, permission must be obtained in advance. It is the belief of the faculty of the College that such enrollment detracts from the educational process at this institution, and can be justified only in the most unusual circumstances. Normally, if the material for which such permission is sought is available at OSU, permission will not be granted, nor will retroactive permission be granted in any circumstances.

High School Preparation

Beginning engineering students who have completed two units of algebra and one each in plane geometry and trigonometry/analysis in high school should be prepared to enter at the expected level in mathematics. In addition, students who can should obtain high school credit in one unit of general chemistry, one unit of general physics, and a course in calculus, if available.

Oklahoma State University offers course work in algebra, trigonometry and preparatory chemistry for students who were unable to obtain this work during high school. However, such credit does not count toward the minimum number of semester hours specified for the B.S. degree in engineering.

General chemistry, college algebra and trigonometry credits may count toward B.S. degrees in engineering technology, and general chemistry may be used as an elective in architecture.

General Education Requirements

For students in Engineering, Architecture and Technology, courses in the humanities and social sciences provide both a broadening of the education and essential background for addressing the critical issues in society. Students should

contact an adviser in the CEAT Office of Student Academic Services to select sequences of courses that meet both of these objectives and satisfy the OSU general education requirements.

Schools of Engineering

Each of the schools of engineering offer bachelor's, master of science, and doctor of philosophy degree programs. The common curricular objectives for the engineering programs are to develop each student's: (1) capability to delineate and solve in a practical way the engineering problems of society, (2) sensitivity to the socially-related technical problems which confront the profession, (3) understanding of the ethical characteristics of the engineering profession and practice, (4) understanding of the engineering responsibility to protect both occupational and public health and safety, and (5) ability to maintain professional competence through life-long learning.

The Professional School Concept

In accord with the professional nature of a career in engineering, a student entering OSU is admitted into the pre-engineering program, consisting of the course work normally taken the first two years of an engineering curriculum. Near the completion of the pre-engineering course work, the student is considered for admission to one of the professional schools of the College to continue in the upper-division program. Upon meeting admission standards the student then pursues a curriculum leading to the B.S. degree or graduate education in his or her discipline.

Preprofessional School. The content of the pre-engineering program is similar for most engineering specialities, and includes course work devoted to mathematics through calculus and differential equations, communication skills, general chemistry, general physics, engineering sciences, social sciences, and humanities.

Professional School. Upon formal admission to the professional school of his or her choice, the student proceeds through the junior and senior years of the degree program, fulfilling "Major Requirements" as listed on the degree requirements sheets in the publication *Undergraduate Programs and Requirements* that is considered a companion document to this *Catalog*. Upon completion of all degree requirements, the student is awarded the Bachelor of Science degree.

Master of Science and Doctor of Philosophy. These degree programs are available in each engineering school to prepare engineers for careers in advanced engineering, research and development. The programs are described under each school's headings, and in the "Graduate College" section of the *Catalog*.

The College of Engineering, Architecture and Technology also participates in interdisciplinary Master of Science programs in control systems engineering, engineering and technology management, health care administration, and telecommunications systems management. The Master of Manufacturing Systems Engineering is also offered in the College. All of these programs are available using distance learning technologies and most may be taken by resident students on campus. See the "Graduate College" section of this catalog for further information.

Admission Requirements

All new engineering students at Oklahoma State University are first admitted to the preprofessional school program. Regardless of previous background all new engineering students must enroll in ENGR 1111. Students transferring to preprofessional school from another major at OSU or University Academic Services must meet the same requirements for admission as a student transferring from another college or university.

Resident transfer students will be admitted directly to preprofessional school if they satisfy all OSU resident transfer student requirements and have a GPA of at least 2.00 not to include activity, performance or remedial courses in the most recent semester completed.

Nonresident transfer students admitted to OSU may enter directly to preprofessional school if they appear to have the ability to make satisfactory progress toward an engineering degree as indicated by the following:

1. An overall GPA of at least 2.70, and
2. A GPA of at least 2.50 over all mathematics, physical science, engineering science and engineering courses, and
3. A GPA of at least 2.00 (in at least 12 hours if a full-time student) in the most recent semester completed.

For these purposes, all GPAs are calculated using only the last grade in any repeated course.

Students not directly admissible to preprofessional school but those who meet OSU requirements for admission may be admitted to University Academic Services for one or two semesters in order to fully evaluate their qualifications for admission to pre-engineering. After grades are received each semester, such students may be evaluated and, if qualified, will be admitted to pre-engineering.

International student applications must be received by June 15, November 1 and April 1 for the fall, spring and summer terms, respectively, to be considered for admission to pre-engineering.

Admission to the Professional Schools. In each school of engineering the lower-division course work is devoted to preparing the student for professional school.

To be admitted to one of the professional schools of engineering, the student must have:

1. Completed a minimum of 60 semester credit hours in an accredited institution of higher learning.
2. Demonstrated an acceptable level of competence in subject material comparable to that covered in Pre-engineering, i.e., General Education and Common Pre-engineering. Such demonstration may be by completion of course work or by examination with not more than half the requirements satisfied by examination.
3. Been formally accepted by a professional school.

An acceptable level of competence for admission to a professional school may be demonstrated by:

a. Completion of the preprofessional school requirements as designated on the flow chart corresponding to the student's matriculation date and major, with an overall grade-point average of 2.30 or higher in these courses. Students may be deficient in no more than nine of these hours, and must have completed the required sequences in calculus, general physics, general chemistry, English composition, and at least two engineering science courses.

b. Final grades of "C" or better in all courses submitted to meet the University's English composition requirement.

c. Completion at OSU of at least 12 semester credit hours of courses required for the degree, with a grade-point average of 2.30 or higher in these courses. This must include at least nine hours of technical subjects with a GPA of 2.50 or higher.

d. Achievement of an overall grade-point average of 2.50 or higher in the required mathematics, physics, chemistry, engineering science and

engineering courses completed prior to admission to a professional school and final grades of "C" or better in each of these courses.

For these purposes, all GPAs are calculated using only the last grade in repeated courses. Individual schools may impose higher standards for admission. Currently, the School of Electrical and Computer Engineering requires a 2.60 and 2.70 respectively where 2.30 and 2.50 are indicated in a., c., and d. above.

In addition, if the number of qualified professional school applicants to a given professional school exceeds the number that can be provided a quality program with the resources available, the number admitted each year to that professional school will be limited. In that event, priority for admission will be given to pre-engineering students on a best qualified basis as determined by the grade-point average in relevant courses taken and completed at OSU and professional potential. This practice will preserve the high standards demanded of a quality educational experience sought by students and is necessary so that OSU graduates will continue to be highly regarded. As an example, a maximum of 90 new students can be admitted each year to the professional school of Mechanical and Aerospace Engineering.

Students may enroll in no more than nine hours of upper-division major requirements prior to admission to professional school unless they secure permission from the head of the school.

Class Placement

The selection of the initial chemistry and mathematics courses for an entering student in the College of Engineering, Architecture and Technology is determined by the amount of and grades in mathematics or chemistry completed in his or her high school program, and ACT test scores. When appropriate, students with a strong background can obtain academic credit by advanced standing examination or by College Level Examination Program (CLEP) tests.

Academic Advising

The College's Office of Student Academic Services provides advisement for all pre-engineering students. When a student has gained admission to a professional school of engineering, he or she will be assigned a faculty adviser in the school.

Each student is personally advised in the planning and scheduling of his or her course work and is counseled and advised individually on matters of career choice, his or her activities at OSU, and on other academic matters. An academic file is created for each student at the time of initial enrollment.

Each student and his or her adviser must carefully select elective courses to meet the curriculum objectives and accreditation criteria. Specific criteria include appropriate computer-based experiences, knowledge of probability and statistics, competence in written and oral communications, an understanding of ethical, social, economic and safety considerations, and engineering design experiences that are integrated throughout the curriculum. The engineering design experiences begin with ENGR 1322, 1332, 1342 or 1352 (depending on the student's major) and culminate with a major engineering design experience specified on the degree requirement sheet. The adviser assists the student in this effort and tries to assure accuracy and compliance; however, the ultimate responsibility for meeting degree requirements rests with the student.

General Education Requirements

Opportunities to satisfy General Education requirements with required courses in the schools of engineering include:

English. Students are required to complete a course in technical report writing. Thus, students making an "A" or "B" in the first English composition course (ENGL 1113), need not take ENGL 1213, and may take ENGL 3323, to meet both the General Education requirement for English and the College requirement for technical writing.

Humanities and Social Science. Engineering students must complete a total of 18 semester credit hours to meet this requirement. By taking American history and political science, six additional hours of social and behavioral sciences, and six hours of humanities, the 18 hours will meet the University's requirements in these areas. Humanities and Social Science courses must be selected with the assistance of a CEAT adviser in order to assure compliance with accreditation requirements and the University's requirement for an International Dimension.

Biosystems and Agricultural Engineering

Professor and Head Ronald L. Elliott, Ph.D., P.E.

The School of Biosystems and Agricultural Engineering is administered jointly by the College of Agricultural Sciences and Natural Resources and the College of Engineering, Architecture, and Technology.

Biosystems engineers are professionals who create and adapt engineering knowledge and technologies for the efficient and effective production, processing, storage, handling and distribution of food, feed, fiber and other biological products, while at the same time providing for a quality environment and preserving and protecting natural resources. Subject-matter specialization is provided through the following undergraduate option areas: food and bioprocessing, environment and natural resources, biomechanical, and general agricultural engineering.

Biosystems engineering courses integrate engineering sciences, physical sciences, and biological sciences, and tech students to address real-world challenges. With the guidance of experienced faculty, students work both as individuals and in teams to design creative solutions to complex problems.

The overall objective of the undergraduate biosystems engineering degree program is to provide the comprehensive education necessary to prepare students for successful, productive and rewarding careers in engineering for agricultural, food and biological systems. Graduates of the program will:

be able to apply mathematical, physical, engineering, and biological principles needed to understand, analyze, and solve problems in food, agricultural, environmental and biological systems.

be effective in oral, written and visual communications.

be self-motivated in accomplishing tasks, both as an individual, and as a contributor to multi-disciplinary teams.

be able to understand the social, environmental, safety and economic impact of their work in local and global contexts, and to perform in a professional and ethical manner.

be committed to enhancing knowledge and skills through continuing education.

The undergraduate educational program is divided into two components—preprofessional and professional. In the preprofessional portion of the biosystems engineering program (usually equivalent to two years of study) the focus is on the underlying biological, physical, chemical and mathematical principles of engineering, supplemented by appropriate general education courses in English, social sciences and humanities. Students who demonstrate proficiency in this portion of the program are eligible for admission to the professional school in biosystems engineering.

The professional school of biosystems engineering curriculum (typically two years) builds systematically upon the scientific knowledge acquired in the preprofessional curriculum. In professional school, students have the opportunity to focus on the option areas given above. The degree is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under criteria for agricultural engineering and similarly named programs.

Each professional school course builds upon preceding engineering courses to develop in the student the ability to identify and solve meaningful engineering problems. The course work is specifically sequenced and interrelated to provide design experience at each level, leading to progressively more complex, open-ended problems. The course work incorporates the social and economic aspects of technical problems, and stresses the responsibilities as engineering professionals to behave ethically and promote occupational and public safety. The program culminates in senior year design courses in which students integrate the analysis, synthesis and other abilities they have developed throughout the earlier portions of their study into a capstone experience. At this point, they are able to design components, systems and processes that meet specific requirements, including such pertinent societal considerations as ethics, safety, environmental impact and aesthetics. The students have also developed and displayed the ability to conduct experiments essential to specific studies and to analyze the experimental results and draw meaningful conclusions.

An integral part of this education continuum from basic science through comprehensive engineering design are learning experiences that facilitate the students' abilities to function effectively in both individual and team environments. Moreover, the program provides every graduate with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational tools are introduced and used as a part of their problem-solving experiences. Finally, the students' experiences in solving ever-more-challenging problems enables them to continue to learn independently throughout their professional careers.

A wide variety of employment opportunities are available for biosystems engineers in industry, public service and education. Some of these opportunities include positions in governmental agencies, consulting, engineering firms, and agricultural and food equipment industries. Biosystems engineers are employed throughout the U.S. as well as internationally.

Students interested in a degree in biosystems engineering may initially enroll in either the College of Engineering, Architecture and Technology or the College of Agricultural Sciences and Natural Resources. Students who enroll in the College of Agricultural Sciences and Natural Resources should request a biosystems engineering adviser and transfer to the College of Engineering, Architecture and Technology by the end of their first semester.

Graduate Programs

The School of Biosystems and Agricultural Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees. These degrees emphasize research and development.

Excellent laboratory and computer facilities are available for students to explore research and design in such areas as bioprocessing and food engineering, machine vision, sensor and control technology, waste management and utilization, hydrology, water quality, porous media flow, and intelligent systems for agricultural production.

Research projects are supported by the Agricultural Experiment Station and by state, federal and private grants and contracts. A well-trained faculty, many of whom are registered professional engineers with research, consulting and design experience, guide the graduate students' activities and plan programs to meet students' needs. Graduate students design experiments and special equipment to conduct their work. They are expected to demonstrate, by supporting research or by designs, the ability to identify a problem, define alternatives, propose a solution, organize a design or an experimental investigation, carry it to completion and report the results.

Admission Requirements. Admission to either the Master of Science or Doctor of Philosophy degree program requires graduation from an engineering curriculum accredited by the Accreditation Board for Engineering and Technology. Students without accredited degrees may be admitted provisionally and may be required to take additional courses.

A student must be accepted by an adviser in the department prior to official admission to the graduate program.

Degree Requirements. A candidate for either of the graduate degrees listed above follows an approved plan of study which must satisfy at least the minimum University requirements for that particular degree.

Chemical Engineering

Professor and Head R. Russell Rhinehart, Ph.D.

Chemical engineers use the language of mathematics to describe the chemical and physical behavior of molecules (solid, liquid, gas, or plasma). This ability is used to design and operate processes that produce useful products. Chemical engineers work in a wide range of industries that make pharmaceuticals, fuels, biochemicals, semiconductor materials, foods, plastics, paper, petroleum products and chemicals. Key to providing a benefit to society, chemical engineers are responsible for resource conservation, minimizing pollution, minimizing costs, and maximizing quality and safety of processes that make the products.

The emphasis on the chemical nature of everything people use is what makes chemical engineers different from other engineers. The emphasis on the processes that make the products is what makes chemical engineers different from chemists.

Chemical engineers often find themselves defining a problem or product, developing a process to do what is needed, and then designing the plant to carry out the process. After the plant is started, chemical engineers commonly manage operations, oversee equipment maintenance, and supervise control of product quality. They trouble-shoot the problems which hinder smooth operations, and they plan for future expansions or improvements. Their training and knowledge make them well qualified to market the products from a plant, the processing equipment for plants, or even the complete plant itself. The varied background and experience of chemical engineers make them ideally suited for advancement into top-level managerial and executive positions.

Educational Objectives

Educational objectives for the School of Chemical Engineering desire that within the first few years after graduation, graduates will have demonstrated the ability to:

1. Work in a manner that is characterized as "good engineering", e.g.,
   a. Deliver things and procedures that work within the comprehensive situation.
   b. Creatively use fundamental principles, knowledge, skills, and state-of-the-art tools in a careful, legitimate way.
   c. Appropriately balance sufficiency, uncertainty, and risk with perfection.
   d. Use care for human welfare as a primary value.
   e. Work effectively within both team and individual environments.
   f. Learn and apply job-specific technology.
2. Be professional partners with both employer and community, and create value, e.g.,
   a. Have a desire to contribute and succeed.
   b. Learn the culture, mores, and values of the new environment and operate in a manner that is acceptable and credible to the system.
   c. Communicate effectively so that the system accepts the deliverables.
   d. Be self-developing and self-actualizing.
   e. Effectively use company resources.
   f. Develop relationships that are beneficial for long-term team effectiveness.
   g. Learn enterprise objectives so that contributions are guided by mission-critical issues.
   h. Be receptive to and a catalyst for change (personal, organizational, technical).
3. Enjoy life, e.g.,
   a. Enjoy work.
   b. Engineer personal life.
   c. Grow.

The goal of the B.S. degree program is to produce graduates who possess broad-based knowledge, skills and judgment that prepares them to succeed in the profession of engineering or in further studies at the graduate level including medical school. To achieve this goal, the program is designed to progressively develop both technical and human skills.

In the preprofessional portion of the chemical engineering program (usually equivalent to two years of study), the focus is on the underlying scientific and mathematical principles of engineering, supplemented by appropriate general education courses in English, social sciences and humanities. Students who demonstrate proficiency in this portion of the program are eligible for admission to the professional school.

The curriculum in the professional school (typically the second two years) builds systematically upon the scientific knowledge acquired in the preprofessional curriculum. In professional school, students have the opportunity to focus in one of three emphasis areas: (1) the regular course prepares a graduate for a wide range of employment opportunities; (2) the biomedical and premedical options are for those who wish preparation for medical school or seek employment in bio-related professions; and (3) the environmental option is for those who wish to emphasize environmentally-related studies. Each emphasis area is accredited under the basic level ABET criteria for chemical engineering programs and each prepares a student for success in both employment and graduate study at OSU or other universities. A more complete description of exact degree requirements for the bachelor's-level curricula is given in the publication *Undergraduate Programs and Requirements at OSU*.

Admission requirements for the professional school are:

Completion of at least 60 college level semester credit hours (SCH).

Completion of at least 12 SCH from OSU.

Completion of at least 51 SCH from the preprofessional school courses.

Completion of MATH 2145, 2155, and 2233; PHYS 2014 and 2114; CHEM 1515, 3053, and 3153; ENSC 2213 and 3233; CHE 2033, ENGL 1013 (or 1113 or 1313), and, if required, ENGL 1033 (or 1213 or 1413).

An overall GPA of 2.30 or better at OSU.

A GPA of 2.50 or better, in all of the college-level science and engineering courses taken at OSU and required for the B.S. These courses depend on degree option, but include MATH, STAT, PHYS, CHEM, BIOL, GEOL, ENGR, ENSC, CHE, etc.

A final grade of "C" or better in each of these technical and English courses.

Each professional school course builds upon the preceding chemical engineering courses to develop the ability to identify and solve meaningful engineering problems. The course work is specifically sequenced and interrelated to provide design experience at each level, leading to progressively more complex, open-ended problems. The course work includes sensitizing students to socially-related technical problems and their responsibilities as engineering professionals to behave ethically and protect occupational and public safety. The program culminates in the senior-year design courses in which the students integrate the analysis, synthesis and other abilities they have developed throughout the earlier portions of their study into a capstone experience. At this point, they will be able to design components, systems and processes that meet specific requirements, including such pertinent societal considerations as ethics, safety, environmental impact and aesthetics. The students will have developed and displayed the ability to design and conduct experiments essential to specific studies, and to analyze the experimental results and draw meaningful conclusions within an enterprise context.

An integral part of this educational continuum from basic science through comprehensive engineering design are learning experiences that facilitate the students' abilities to function effectively in both individual and team environments. Moreover, the program provides every graduate with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational tools are introduced and used as a part of their problem-solving experiences. Finally, the students' experiences in solving ever-more-challenging problems give's them the ability to continue to learn independently throughout their professional careers.

Upon completing the B.S. studies the qualified student is encouraged to continue in the master's program.

Graduate Programs

The School of Chemical Engineering offers programs leading to the Master of Science and Doctor of Philosophy. A program of independent study and research on a project under the direction of a member of the Graduate Faculty will be satisfactorily completed by all graduate students. For the Master of Science candidate, the project may result in a thesis. For the Doctor of Philosophy candidate, the project will result in his or her dissertation.

Admission Requirements. Admission to either the Master of Science or Doctor of Philosophy degree program requires graduation from a chemical engineering curriculum approved by the Accreditation Board for Engineering and Technology (ABET). Graduates from other curricula should submit transcripts to the

head of the School of Chemical Engineering for evaluation.

The Master of Science Degree. General requirements for the Master of Science degree in chemical engineering are 30 semester credit hours of work beyond the B.S. degree and an acceptable thesis. At least 18 hours must be in class work and a minimum of six hours of credit is required for thesis research. The courses taken must include CHE 5123, 5213, 5743, and 5843.

The Doctor of Philosophy Degree. The general credit requirement is a minimum of 90 semester credit hours beyond the B.S. degree including at least 36 hours of credit for research and at least 30 hours of class work. The courses must include CHE 5123, 5213, 5743, 5843, and 6703. Each student is responsible for consultation with his or her advisory committee in preparing the study plan.

Civil and Environmental Engineering

Professor and Head Gorman Gilbert, Ph.D.

Civil engineers build the future. The exceptional diversity of professional practice in civil engineering presents many career opportunities for students well-founded in the physical sciences, mathematics, and engineering sciences.

The concern of civil engineers is a person's environment—its design, its control, its construction, control, alteration and utilization. Civil engineers plan, design and construct buildings, highways, waterway and railway systems, harbors and shipping facilities, systems for the treatment and distribution of water and for the collection and treatment of sewage and industrial waste, dams and hydroelectric works, airports and terminals, structures of every kind including buildings, bridges, towers, industrial plants, tunnels and subway systems, schemes for the control of water and air pollution, and many other works of general benefit to society.

The professional curriculum in civil engineering is based on the pre-engineering courses in mathematics, physical sciences and engineering sciences. On this foundation, required courses train the student in the basic skills needed for the professional practice of civil engineering and provide the tools for more advanced study. Engineering theory and principles are developed in a way that will encourage their application to the solution of practical problems. Elective courses give experience in the solution of typical problems and develop the judgment and confidence of the student engineer.

The goals of the School are to provide a curriculum that is effective and balanced among the major areas of civil engineering practice; to provide practical exposure to laboratory, computational, and design experiences that will enhance performance in the practice of civil engineering; to enhance communicative skills; to encourage and experience in team participation; and to ensure student understanding of the ethical and societal responsibilities of professional practice. Program curricula requirements are outlined in the publication *Undergraduate Program and Requirements* that is considered a companion document to the *Catalog*. The civil and environmental program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under the criteria for civil and similarly named engineering programs.

Design talents are developed through a series of courses in which the design component is integrated into course instruction. The first design experience occurs in the freshman year with a computer-aided design course. Concrete, steel, geotechnical and environmental design experiences occur in junior and senior level courses. The design component is culminated by a senior design experience using previous design exposure. The design requirements are provided in the publication *Undergraduate Programs and Requirements*.

Engineering ethics, occupational and public health and safety issues; teamwork; contemporary issues involving state, federal and local government issues; and professional practice are integrated into the course curriculum.

Some degree of specialization is provided through the choice of elective courses in structures, engineering mechanics, transportation engineering, soil mechanics and foundations, construction engineering and management, environmental engineering and water resources. There is a designated emphasis for those students wishing to concentrate more heavily in the environmental area of practice. The environmental emphasis is accredited as a civil engineering program. Strong support for various parts of the program are given by the departments of Industrial Engineering and Management, Mechanical and Aerospace Engineering, Agronomy, Chemistry, Geology, and Microbiology.

Oklahoma State University and the University of Oklahoma established the Oklahoma Transportation Center (OTC) as a cooperative venture with the Oklahoma Department of Transportation (ODOT), and other transportation agencies, operators and suppliers. The mission of the Center is to develop and transmit knowledge through research, training, technical assistance, and technology transfer to enhance the transportation systems that touch the lives of the people of Oklahoma and the nation. This mission is straightforward; it is to solve problems in all areas of transportation.

Graduate Programs

The School of Civil and Environmental Engineering offers five programs leading to post-baccalaureate degrees—the Master of Civil Engineering degree, the Master of Environmental Engineering degree, the Master of Science degree in civil engineering, the Master of Science degree in environmental engineering, and the Doctor of Philosophy degree. The Master of Civil Engineering and the Master of Environmental Engineering degrees are graduate professional degrees with increased emphasis on professional practice through a broad spectrum of management, economic and technical studies and the incorporation of actual engineering design experience before graduation. The Master of Science degree, on the other hand, is characterized by a higher degree of technical specialization in a particular area of study. The Doctor of Philosophy degree is designed to prepare a student for research and for the teaching profession in engineering.

Major areas of study in the School are applied mechanics, structural analysis and design, transportation, construction engineering and management, geotechnical engineering, water resources, and environmental engineering. Research in all major fields is continuously pursued. Master of Civil Engineering candidates may choose either to specialize or to engage in a broadly based program of study, in accordance with an approved and purposeful plan of study.

Admission Requirements. Candidates for the Master of Science or Doctor of Philosophy degree must have graduated from a civil engineering curriculum accredited by the Accreditation Board for Engineering and Technology. Graduates from other curricula and schools should submit transcripts to the head of the School of Civil and Environmental Engineering for evaluation. Admission to the Master of Science in environmental engineering degree program is permitted for students who meet the minimum

prerequisites as established by the School of Civil and Environmental Engineering.

Degree Requirements. All degree programs follow an approved plan of study that must be submitted at a designated time. All programs are characterized by the flexibility available in a study plan that is designed to satisfy the particular needs of the student, while conforming to the general requirements implied by the title of the degree and specified by the University.

The Master of Science degree in either civil or environmental engineering requires the completion of at least 30 semester credit hours beyond the bachelor's degree, including a research thesis for which not more than six semester credit hours may be granted. The non-thesis option (32 semester credit hours) described in the "Graduate College" section may be permitted at the discretion of the student's advisory committee.

The Doctor of Philosophy degree requires the completion of at least 90 semester credit hours of course work beyond the bachelor's degree, including not more than 30 semester credit hours for the research thesis. In addition, the candidate must complete six semester credit hours of course work in an area such as languages, mathematics, statistics, experimental techniques, research methodology, or similitude, (as specified by the advisory committee) that will facilitate his or her research effort. Generally, official admission as a candidate for the Doctor of Philosophy degree in any program offered by the School will not be granted until a member of the Graduate Faculty in the School agrees to serve as major (or thesis) adviser for the prospective candidate.

Electrical and Computer Engineering

Professor and Head
Michael A. Soderstrand, Ph.D.

Electrical Engineering

The electrical engineering program provides the fundamentals for a career in many related areas. All around is seen the astounding impact of microelectronics on consumer products such as calculators, electronic watches, TV games, home computers and microwave ovens, but the future impact will be even more astounding on worldwide satellite communications, energy conservation, automation of industrial plants, oil and gas exploration, electrical power generation and distribution, to mention a few.

The curriculum is planned to provide skills in the analysis of engineering problems and the design of solutions to those programs. It provides experience in working as a team member on design projects. Emphasis is placed on the development of both written and oral communications skills and the concept of professionalism including the importance of life-long learning.

The School of Electrical and Computer Engineering offers a full range of undergraduate and graduate program choices. A degree in electrical or computer engineering is also an excellent foundation for graduate work in other professional fields such as medicine and law. Many graduates also pursue advanced programs in business and management after earning a degree in engineering.

The undergraduate electrical and computer engineering program at Oklahoma State University prepares each graduate for a life-long professional career. During the first two years, students complete a carefully designed preengineering program consisting of mathematics, physical sciences, engineering sciences, introductory electrical engineering courses, and selected courses in the humanities and social sciences. During the final two years of the program, each student concentrates his or her study on electrical and computer engineering subjects and can elect from the following areas: computer engineering, electronics, energy systems, communications, control systems, electromagnetics, solid state devices, optics, and network theory/signal processing. Specific elective courses must be selected to assure that the design experience is integrated throughout the curriculum, culminating in the two major design courses at the senior level.

Computer Engineering

A special emphasis area in computer engineering is offered by the School of Electrical and Computer Engineering. This area is designed for students who have a strong interest in computers and desire to gain a full understanding of both the electronic hardware and the programming software aspects of modern computer systems. A student in the computer engineering emphasis area will also gain a detailed knowledge of one or more applications where computers are being used as integral components of advanced engineering systems; examples are instrumentation and test facilities, communication systems, power systems and process control systems. These students will work directly with microprocessors, microcomputers, and minicomputers and develop special electronic circuits for interfacing these computers to various peripheral devices.

In addition to the laboratories devoted to research, separate instructional laboratories give students "hands-on" experience in microcomputers, minicomputers, digital logic design, electronics, electrical machinery, networks, instrumentation and electromagnetics. In most instances, the student is guided through laboratory exercises which are closely related to classroom lectures. Here the student has the opportunity to verify theoretical principles and design concepts presented in the lectures. In other courses, the laboratory formats are more open-ended, allowing the student to experiment freely and exercise individual discretion in discovering experimental results.

This emphasis area, as part of the electrical engineering program described above, is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under the criteria for electrical and similarly named engineering programs.

Graduate Programs

The School of Electrical and Computer Engineering offers two graduate degrees: Master of Science and Doctor of Philosophy. Students interested in a Master of Electrical Engineering degree program should contact the department head.

The Master of Science degree is designed for students interested in careers in industry and government service that emphasize advanced design, development, and research methods for high technology. This degree incorporates additional advanced course work and on-campus creative activities.

The Doctor of Philosophy degree is designed to prepare the student for high-level research and development positions in industry and government and for the teaching profession in engineering, and is distinguished by the emphasis on research and by the incorporation of a doctoral thesis.

Students may select course work and participate in research and design projects in the following areas: computer engineering, energy systems, control theory, communications, signal/speech/image processing, electromagnetics, electronics, network theory, solid-state devices, artificial intelligence, parallel processing, optoelectronics and lasers.

In addition, students may elect a multidisciplinary program that crosses

departmental lines and emphasizes the application of electrical engineering and systems theory to complex problems involving the interaction of engineering systems and technology with social, economic and environmental processes.

Admission Requirements. Admission to the Graduate College, as described under "General Regulations" in the "Graduate College" section of the *Catalog* is the first step for those students proceeding toward advanced degrees. Graduation with high scholastic performance from an electrical engineering curriculum accredited by the Accreditation Board for Engineering and Technology qualifies the student for admission to the School of Electrical and Computer Engineering as a candidate for the advanced degrees offered.

Graduates from non-engineering fields such as mathematics, physics and computer science are also admitted to the School of Electrical and Computer Engineering M.S. and Ph.D. graduate programs, if an evaluation of their transcripts indicates they are prepared to take graduate-level course work in electrical engineering, or can be expected to do so after a reasonable amount of remedial course work. This condition also applies to graduates of unaccredited engineering programs and engineering technology programs.

Degree Requirements. The Master of Science degree is awarded to those students who successfully complete an approved plan of study under one of two possible options. If a thesis is written, 30 semester credit hours are required, including six hours credit for the thesis. If no thesis is written, 32 semester credit hours are required, including two hours credit for a creative activity. To be approved, a plan of study will include, as a minimum, 18 hours of 5000-level courses in electrical and computer engineering. Most plans of study include additional 5000-level courses, depending upon the background and particular educational goals of the student, and the minimum stated above is allowed only when a specific interdisciplinary plan of study is approved by the faculty. Each student is encouraged to include courses in supporting disciplines such as mathematics, computer science, statistics, business or other engineering fields. As mentioned above, some remedial work in undergraduate electrical and computer engineering may be required in addition to the 30-32 hours specified above.

The Doctor of Philosophy degree is granted in recognition of high achievement in scholarship in course work selected from the broad field of electrical engineering, and an independent investigation of a research problem in a chosen field of specialization that leads to a contribution to knowledge, as presented in a dissertation. For this degree the Graduate College requires a minimum of 90 credit hours for acceptable academic work beyond the bachelor's degree, including credit for the dissertation.

The School of Electrical and Computer Engineering also participates in the Master of Control Systems Engineering and the Master of Manufacturing Systems Engineering programs. (See "Graduate Programs" under "Industrial Engineering and Management," and "Telecommunications Management" in the "Graduate College" section.)

Industrial Engineering and Management

Professor and Head William J. Kolarik, Ph.D., P.E.

Industrial engineering and management (IE&M) focuses on production systems that provide products (goods and services) for customers throughout the world. Industrial engineers define, design, build, operate, and improve production processes that convert resources to products effectively (e.g., high quality), efficiently (e.g., high productivity), and safely.

People are the fundamental component of production systems–people provide the creativity and leadership essential to make things happen. Hence, industrial engineering is the most people-oriented discipline within the engineering family. Industrial engineers are trained to think in both broad and specific terms. Practicing industrial engineers understand business parameters as well as physical and social parameters within production systems. This breadth allows industrial engineers to function effectively in a wide spectrum of activities ranging from strategic business planning to detailed task design. The wide-angle vision of industrial engineering provides career flexibility, leading to high-level leadership or specialized technical responsibilities.

Industrial engineers are found in manufacturing organizations (e.g., automotive, electronics, medical, and food manufacturers), service enterprises (e.g., hospitals, banks, airlines, and consulting groups), and governmental organizations (e.g., public service and regulatory organizations).

The School of Industrial Engineering and Management's vision is to be internationally recognized by industry and academia for excellence in education, research, extension and service. Its mission is to discover, verify, integrate and transfer knowledge and methodologies relating to enterprise design and management, information technology, and modeling and optimization for the benefit of students, research sponsors and the technical community. The faculty, students and staff work together to build and maintain a learning and mentoring environment where:

innovative practices are developed, tested and validated.

knowledge and practices are shared.

each individual develops to his or her full potential.

professional ethics are practiced at all times.

The educational program emphasizes the application of technologies and tools in the short term, and the ability to discover, acquire, and adapt new knowledge and skills in the long term, such that graduates are prepared to:

define, analyze and solve complex problems within and between enterprises.

discover, understand and incorporate appropriate new technologies in the design and operation of enterprises.

lead and manage design, development and improvement efforts that benefit customers, employees and stakeholders.

function in culturally diverse teams, communicate in a professional manner, and uphold the ethical standards of the engineering profession.

Graduating baccalaureate students possess an understanding of fundamental industrial engineering and management concepts, methodologies and technologies as demonstrated by:

an ability to apply knowledge of mathematics, probability and statistics, science, engineering, and engineering economy.

an ability to design and conduct experiments involving risk and uncertainty, as well as to analyze and interpret data.

an ability to design a system, component or process to meet desired needs.

an ability to function on culturally diverse, multi-disciplinary teams.

an ability to identify, formulate and solve engineering problems involving physical, human and economic parameters.

an understanding of professional and ethical responsibility.

an ability to communicate effectively.

the broad education necessary to understand the impact of engineering solutions in a global and societal context.

a recognition of the need for, and an ability to engage in life-long learning.

a knowledge of contemporary issues and the role of the human in enterprise activities.

an ability to use the techniques, skills and modern engineering tools necessary for industrial engineering and management practice.

The curriculum consists of three primary parts: (1) general studies, (2) core engineering, and (3) professional school topics. General studies consist of courses such as math, statistics, chemistry, physics, English, behavioral science, history, humanities, and arts. Core engineering courses consist of engineering sciences such as materials, statics, electrical circuits, fluid mechanics, and thermodynamics. Professional school courses consist of topics such as systems thinking and analysis in engineering, economic analysis, manufacturing processes, computer-aided modeling, work analysis, operations research, quality control, experimental design, facility location and layout, management and leadership, production control, system simulation modeling, information systems and decision support, ergonomics and human factors, and energy and water management. A capstone design experience, working with a real-world organization, brings all of the classroom and lab work together in the senior year. Details regarding degree requirements are available in the *Undergraduate Programs and Requirements* publication.

The program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under the criteria for industrial and similarly named engineering programs.

Each IE&M student, along with the faculty adviser, works out an individual plan of study which guides them through the curriculum. The course work is sequenced and interrelated to provide theoretical and applied knowledge, along with hands-on laboratory and project experience. Students work as individuals and as teams to integrate and apply mathematical, scientific, and engineering knowledge and concepts in order to address both traditional academic questions as well as open-ended design and analysis challenges. Instruction in experimental methods is integrated in the curriculum through the design, execution, analysis, and interpretation of experiments. Project work is used to develop both technical and communications skills. Technical skills are used to identify, formulate, and address engineering problems, both simple and complex. Communications skills are addressed and practiced in written, oral and team interaction formats.

The means to define and design detailed solutions to address customer needs from a system-wide perspective is introduced in the sophomore year, and reinforced through the capstone senior design project. Additionally, global perspectives of production systems are introduced and emphasized in the sophomore year so that students understand the nature of global customer bases as well as global competition early in their studies. The curriculum is continually updated to assure that contemporary issues, thinking, and tools are integrated in course content as well as instructional delivery. Professional responsibility and ethical behavior are introduced and reinforced throughout the curriculum. Additionally, the need for life-long learning after graduation is stressed.

Students are offered opportunities to enhance their classroom and laboratory experiences through student organizations such as the student chapter of the Institute of Industrial Engineers and the Institute for Operation Research and the Management Sciences. Outstanding scholars are recognized by Alpha Pi Mu, the national honor society for industrial engineering students. Additionally, opportunities for internship and co-op experiences are offered to IE&M students so that they can gain professional experience during their collegiate program. Please visit our Internet site (www.okstate.edu/ind-engr/) for more information.

Graduation.

1. Grades of "C" or better in all technical courses in the pre-engineering curriculum.
2. Grades of "C" or better in all courses that are prerequisites for IEM courses.
3. 2.00 major (right hand side of requirement sheet) GPA.

Graduate Programs

The School of Industrial Engineering and Management offers graduate programs leading to the Master of Industrial Engineering and Management degree, the Master of Science degree, and the Doctor of Philosophy degree. The School is also one of the joint sponsors of the Master of Manufacturing Systems Engineering degree.

The Master of Industrial Engineering and Management degree is a graduate professional degree with increased emphasis on professional practice, incorporating an engineering design experience during the final year of study.

The Master of Science degree is characterized by a higher degree of technical specialization in a particular field of study. This degree program is designed to prepare students for professional practice that may include research or consulting components.

The Master of Science degree is intended to be especially attractive to industrial engineering graduates, engineering graduates from other disciplines, and many science majors. The Master of Industrial Engineering and Management degree is intended for graduates from an ABET-accredited engineering or technology program. Both degree programs include a strong technical component and an orientation to business and management that is complementary to a technical background.

The Doctor of Philosophy degree is designed to carry the student to the leading edge of knowledge in the profession of industrial engineering and management. It is intended to prepare students for highly specialized positions, such as research and consulting in industry, government and service organizations, and for teaching or research positions in colleges and universities.

The Master of Manufacturing Systems Engineering degree emphasizes a broad exposure to manufacturing from the perspective of the industrial, electrical and mechanical engineering disciplines. Students select courses from all three engineering disciplines. The program is oriented toward engineering practice in integrated manufacturing systems and requires the student to execute an industrial internship. Structured as a terminal degree, it prepares individuals with knowledge of all aspects of manufacturing systems, including management and technical aspects of manufacturing.

The basic consideration in graduate education in industrial engineering and management is effective and efficient utilization of human, physical, and economic resources. Instruction in management embraces both qualitative and quantitative concepts, including analytical methodologies and social considerations pertinent to organizations.

Advanced degree programs are designed with major emphasis in fields of interest such as management, manufacturing systems operations research, quality and reliability, facilities, energy, environmental management, and enterprise modeling and supply chains. Students may complement industrial

engineering and management courses with work in other branches of engineering, as well as economics, business administration, computer science, statistics, mathematics, psychology, and sociology.

Admission Requirements. Admission to the Graduate College is required of all students pursuing the M.I.E.&M., M.S. or Ph.D. degree. Graduation from an industrial engineering curriculum with scholastic performance distinctly above average, qualifies the student for admission to the School of Industrial Engineering and Management as a candidate for the master's and Ph.D. degrees. Graduates from disciplines other than industrial engineering may be admitted if an evaluation of their transcripts and other supporting materials by the School of Industrial Engineering and Management indicates that they are prepared to take graduate-level course work in industrial engineering, or can be expected to do so after a reasonable amount of prerequisite work.

All international applicants must submit GRE scores. In addition, all international applicants must submit TOEFL scores, with two exceptions. Exceptions are made for international students whose native language is English and for applicants who hold at least one degree from a U.S. university.

Degree Requirements. The *Master of Science* degree in industrial engineering and management requires the completion of at least 30 semester credit hours beyond the bachelor's degree, including a research thesis of six semester credit hours. A 33 semester-credit-hour option is also permitted and must include a three credit-hour creative component. The creative component requirment can be met by completing a three credit-hour independent study project or a three credit-hour course approved by the student's committee.

The *Doctor of Philosophy* degree requires the completion of at least 90 semester credit hours of course work beyond the bachelor's degree or 60 semester credit hours of course work beyond the master's degree, normally including an 18 semester credit hour research thesis. In addition, the candidate must complete six semester credit hours of course work in an area such as mathematics, statistics, experimental techniques, or research methodology (as specified by the advisory committee).

The *Master of Manufacturing Systems Engineering* degree requires the completion of 33 semester credit hours beyond the bachelor's degree and normally includes six credit hours based upon an internship in industry.

The School of Industrial Engineering and Management also participates in the health care administration specialization, offered through the natural and applied sciences masters degree program, and the Master of Science in Engineering and Technology Management. Current program information can be found on the World Wide Web (www.okstate.edu/ind-engr.). (See the "Graduate College" section of the *Catalog*.)

Mechanical and Aerospace Engineering

Professor and Head
Lawrence L. Hoberock, Ph.D., P.E.

Mechanical engineering and aerospace engineering are professional disciplines that involve the invention, design, and manufacture of devices, machines and systems that serve the ever-changing needs of modern society.

Mechanical engineering is an exceedingly diverse field that covers an exceptionally wide range of systems, devices and vehicles. Mechanical engineers are vitally concerned with all forms of energy production, utilization and conservation. They deal with everything mechanical, whether it is small or large, simple or complex—from power lawn mowers to automobiles, fuel cells to nuclear power plants, gas turbine engines to interplanetary space vehicles, artificial limbs to life support systems, robotic manipulators to complex automatic packaging machines, precision instruments to construction machinery, household appliances to mass transit systems, and heating and air-conditioning systems to off-shore drilling platforms. In virtually every organization where engineers are employed, mechanical engineers will be found.

The B.S. degree program in mechanical engineering, together with the premedical option in mechanical engineering, is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under the criteria for mechanical and similarly named engineering programs.

Aerospace engineering is concerned with the science and technology of flight, and the design of air, land and sea vehicles for transportation and exploration. This exciting field has already led people to the moon and continues to lead in the expansion of frontiers deeper into space and into the ocean's depths. Because of their unique backgrounds in aerodynamics and lightweight structures, aerospace engineers are becoming increasingly involved in solving some of society's most pressing and complex problems, such as high-speed ground transportation and pollution of the environment.

The B.S. degree program in aerospace engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology under the criteria for aerospace and similarly named engineering programs.

The educational objectives of the mechanical and aerospace B.S. degree programs are: (1) to educate engineers who can identify, formulate and provide effective solutions to real-life, complex problems; (2) to prepare engineers for successful careers by providing them with an appropriate background in mathematics, humanities, the sciences and engineering, and to instill in them a recognition of the need for lifelong learning and of the need to remain current in their chosen disciplines; (3) to educate engineers who can realize successful designs through proper use of classical and modern engineering tools while incorporating engineering standards and realistic constraints; (4) to prepare engineers to contribute successfully within teams and to communicate their ideas and solutions effectively.

The outcome for students graduating from the mechanical and aerospace engineering B.S. programs are: (a) an ability to identify, formulate and provide effective solutions to real-life, complex problems; (b) an ability to design and conduct experiments and analyze and interpret data; (c) an ability to design a system, component or process to meet desired needs; (d) an ability to function on teams, some of which require consideration of multiple disciplines; (e) an ability to identify, formulate and solve engineering problems; (f) an understanding of professional and ethical responsibility; (g) an ability to communicate effectively; (h) an ability to understand the impact of engineering solutions in a societal context; (i) a recognition of the need for, and an ability to engage in, lifelong learning; (j) a knowledge of contemporary issues; (k) an ability to use the techniques, skills and modern engineering tools necessary for engineering practices.

Because mechanical engineering is perhaps the broadest of all engineering disciplines, the program provides not only excellent grounding in all engineering fundamentals, but also allows some flexibility in selecting controlled technical electives to suit the student's interests.

However no one area may be unduly emphasized at the expense of another. For the aerospace engineering and premedical programs, prescribed course work has been selected to provide students with more focused development. Graduates of these programs are fully competent as mechanical or aerospace engineers, including their abilities in design, but also competent in their areas of concentration.

As a fundamental component of all B.S. programs, engineering design is strongly emphasized in the junior and senior years. A minimum of 16 credit hours of design, integrated throughout the curriculum, must be taken by each student. In fact, most MAE courses at the 3000 and 4000 levels includes some design content, ranging from a minimum of one-half to a maximum of four credit hours of design content. Each professional school course builds upon the preceding mechanical and aerospace engineering courses to develop in the student the ability to identify and solve meaningful engineering problems. The course work is specifically sequenced and interrelated to provide design experience at each level, leading to progressively more complex, open-ended problems. The course work includes sensitizing students to socially-related technical problems and their responsibilities as engineering professionals to behave ethically and protect occupational and public safety. The program culminates in a senior-year design course in which students integrate analysis, synthesis, and other abilities they have developed throughout the earlier portions of their study into a capstone experience. The design experiences include the fundamental elements and features of design with realistic constraints such as economics, safety, reliability, social and environmental impact, and other factors. At this point, students are able to design components, systems and processes that meet specific requirements, including such pertinent societal considerations as ethics, safety, environmental impact and aesthetics. Students develop and display the ability to design and conduct experiments essential to specific studies and to analyze the experimental results and draw meaningful conclusions.

An integral part of this educational continuum from basic science through comprehensive engineering design are learning experiences that facilitate the students' abilities to function effectively in both individual and team environments. Moreover, the program provides every graduate with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational tools are introduced and used as a part of their problem-solving experiences. Finally, the students' experiences in solving ever-more-challenging problems gives them the ability to continue to learn independently throughout their professional careers.

The broad background and problem-solving ability of mechanical and aerospace engineers make them suited to engage in one or more of the following activities: research, development, design, production, operation, management, technical sales and private consulting. *Versatility* is their trademark. A bachelor's degree in mechanical or aerospace engineering is also an excellent background for entering other professional schools such as medicine, dentistry, law or business (M.B.A.). The premedical option in mechanical engineering is available for students wishing to enroll in medical school.

In the professional school, (essentially the junior and senior years of the program) mechanical and aerospace engineering students extend their study of the engineering sciences and consider applications of fundamental principles and analysis tools to the solution of real technological problems of society. Students make extensive use of modern electronic digital computers in many courses in their programs. Some design courses involve students in the solution of authentic, current and significant engineering problems provided by industrial firms, such as 3M, Charles Machine Works, Halliburton, Hewlett Packard, Koch Industries, Mercury Marine, Murphy Manufacturing, National Standard, Purolator, and Seagate. Students may also help smaller firms that need assistance with the development of new products.

The student designs, with the guidance of an adviser, an individualized program of study consistent with his or her interests and career plans. Some students terminate their studies with a bachelor's degree, while others receive one of several graduate degrees.

Graduate Programs

The School of Mechanical and Aerospace Engineering offers programs leading to the Master of Science degree, and the Doctor of Philosophy degree. These degrees prepare the graduate for research and development positions in industry and government, or for the teaching profession in engineering. They are distinguished by the incorporation of a research component.

Students may select course work and participate in research or design projects in the following areas: advanced manufacturing processes, aerodynamics, design, computational mechanics, dynamic systems and controls, fluid mechanics, materials processes, solid mechanics, and thermal systems. Students are encouraged to take courses in mathematics and science and in other fields of engineering which fit into their programs.

Admission Requirements. Admission to the Graduate College is required of all students pursuing the M.S. or Ph.D. degree. Graduation from a mechanical or aerospace engineering curriculum accredited by the Accreditation Board for Engineering and Technology, with scholastic performance distinctly above average, qualifies the student for admission to the School of Mechanical and Aerospace Engineering as a candidate for the M.S. and Ph.D. degrees. Graduates from disciplines other than mechanical or aerospace engineering may be admitted if an evaluation of their transcripts by the School of Mechanical and Aerospace Engineering indicates they are prepared to take graduate-level course work in mechanical engineering, or can be expected to do so after a reasonable amount of prerequisite work.

Degree Requirements. All degree programs follow an approved plan of study designed to satisfy the individual goals of the student, while conforming to the general requirements of the School of Mechanical and Aerospace Engineering and the Graduate College.

The Master of Science degree program with the thesis option requires 24 semester credit hours of approved graduate-level course work, and a suitable research thesis of six semester credit hours. The non-thesis option requires 35 semester credit hours of which two must be for an acceptable, directed research activity that results in a written and oral report to the faculty.

The Doctor of Philosophy degree requires a minimum of 90 semester credit hours beyond the bachelor's degree, including a dissertation for which no more than 30 semester credit hours may be awarded.

The School of Mechanical and Aerospace Engineering also participates in the Master of Manufacturing Systems Engineering degree program. (See "Graduate Programs" under "Industrial Engineering and Management.")

School of Architecture

Professor and Head
J. Randall Seitsinger, M.Arch., AIA

The School of Architecture, founded in 1909, offers professional degree programs in both architecture and architectural engineering. The integration of these programs through shared faculty, facilities and course work is a major strength of the School. It is one of the few such integrated programs in the United States, and as such produces graduates who are particularly prepared for the integrated team processes used in professional practice. The School of Architecture is a primary unit in the College of Engineering, Architecture and Technology, and therefore benefits from excellent state-of-the-art resources which significantly enhance the School's professional programs.

The School of Architecture is dedicated to providing a high quality and focused professional education to students whose career goals are to enter the practice of architecture or architectural engineering. Professional and liberal study electives provide opportunities for educational breadth or depth and a possible double degree in both architecture and architectural engineering.

The employment demand for OSU graduates consistently exceeds the supply potential of the School. Oklahoma State University graduates are recruited by the leading architectural and architectural engineering firms both in Oklahoma and nationally. The Oklahoma State University School of Architecture is particularly proud of having among its alumni many of the leaders of the best firms in the country, an AIA Gold Medalist (the highest award given to an architect), and presidents of the American Institute of Architects (AIA) and the National Architectural Accreditation Board (NAAB).

Mission and Goals. Architecture is the difficult and complex art and science of designing and building a setting for human life. It is unique among today's professions in that its successful practice requires a blend, in roughly equal shares, of traits normally considered less than compatible: human empathy, artistic creativity, technological competence, and organizational and economic acumen. In contrast to other fine arts, architecture is rarely self-generated; it is rather a creative response to a stated or perceived human need. It must, therefore, be more user-oriented than fine art alone and more humane than pure science. Its design solutions must avoid the total subjectivity and detachment of other arts while striving to be functionally, technically and economically objective and sound. Yet, in a seemingly insoluble contradiction, the keenest technological and economic functionality will fall far short of becoming architecture unless it also strongly appeals to human spiritual and emotional values. When one thinks of the environment, one cannot help but see or recall architectural images: pyramids in Egypt, Greek and Roman temples, gothic cathedrals, medieval castles, industrial cities, modern skyscrapers and dwellings or entire cities which significantly express the culture and values of the people who live or lived there.

The fundamental mission of the School of Architecture is to focus its unique combination of accredited programs in architecture and architectural engineering to prepare and inspire students for the vital professional leadership roles and responsibilities required to shape the physical environment and to have a positive impact on the social, economic and cultural qualities of life in Oklahoma and the entire international context.

The School of Architecture endeavors to instill in each individual a sensitivity to human needs, a genuine concern for quality, integrity and high ideals, a positive attitude for life-long learning, and an appreciation for one's own self-esteem.

The School's primary goal is to provide excellence in professional education for students preparing to enter the private practice of architecture or architectural engineering. This professional focus is to educate not just qualified candidates for the degree, but graduates who, during their careers, will be licensed professionals and will assume positions of leadership within the profession and society.

Accreditation. The School of Architecture offers two separately accredited professional degree programs. The Bachelor of Architecture degree, B.Arch., is accredited by the NAAB. The Bachelor of Architectural Engineering degree, B.Arch.E., is accredited by the Accreditation Board for Engineering and Technology (ABET) as an engineering program. Both programs require a minimum of five years of study to complete.

In the United States, most state architectural registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes two types of degrees: the Bachelor of Architecture and the Master of Architecture. A program may be granted a five-year, three-year, or two-year term of accreditation, depending on its degree of conformance with established educational standards.

Master's degree programs may consist of a preprofessional undergraduate degree and a professional graduate degree, which, when earned sequentially, comprise an accredited professional education. However, the preprofessional degree is not, by itself, recognized as an accredited degree.

The OSU School of Architecture offers a fully-accredited, five-year, Bachelor of Architecture degree and a one-year post-professional Master of Architecture degree.

Architecture

Architecture is the complex synthesis of creatively solving problems involving both art and science through the disciplined orchestration of image making, activity organization, technological applications, legal constraints, and budgetary parameters which together express culture, enhance quality of life and contribute to the environment.

Education in architecture consists of campus-oriented classroom and studio courses, as well as off-campus studies. It is conducted in an intellectual climate which stimulates inquiry, introduces principles and values, and teaches the disciplines necessary to work in collaboration with others. The goal of the program is the education of future leaders within the architecture profession.

The design studio is the center of the School's educational program. It is the setting where students and faculty work most closely together, and where all specialized study and knowledge comes together and is synthesized in design. The record of OSU students' achievements in the design studios is evidenced by the success in national and international architectural design competitions. In the last 15 years, over 100 OSU students have won or placed in national and international competitions. In addition to a student's design studio education, he or she is required to complete sequential courses in architectural history/theory, technology, and management that work in correlation with the design studio sequence.

The program has long been known as one of the strongest professional programs in the United States. OSU graduates are consistently offered employment opportunities in many of the best architectural offices in Oklahoma and throughout the United States. The program is fully accredited by the National Architectural Accreditation Board.

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Architectural Engineering

Architectural engineering is a profession that combines the art and science known as architecture with a detailed background in fundamental and applied engineering principles. In its broadest sense, it involves the creative application of science and technology to the design of structures meant for human occupancy. Architectural engineering differs from architecture in its focus upon the design of elements, systems and procedures for buildings, rather than the design of buildings themselves. Architectural engineers practice in a wide variety of professional engineering settings such as consulting firms, architectural firms, industrial or commercial organizations and governmental agencies.

The objective of the Bachelor of Architectural Engineering program is to provide basic and professional education to engineering students in building-related structural engineering. OSU graduates will possess broad-based knowledge, skills, and judgment that prepare them to succeed in the profession of architectural engineering or in further studies at the graduate level. The program is designed to prepare students to contribute to society as professional engineers dealing with analysis, design and related activities within the construction industry. The program utilizes the broad resources of the University to exploit a close relationship with the architectural program and to provide in-depth understanding of the professional field and sensitivity to other less technical concerns related to the building environment faced by architectural engineers.

The primary focus of the architectural engineering program at OSU is the safe and economical design of structural systems used in buildings. These structural systems must withstand the various forces of nature such as gravity, winds and earthquakes, as well as the forces of man. These systems require a working knowledge of the mechanics of those materials commonly used for building structures such as steel, timber and reinforced concrete.

The study of architectural engineering is an integrated mix of liberal studies, design and technical education. Architectural engineers need to be able to conceptualize aesthetic issues and design complex technical systems.

In the preprofessional portion of the architectural engineering program (approximately two years of study), the focus is on the underlying scientific and mathematical principles of engineering and the basic design principles of architecture supplemented by appropriate general education courses in English, social sciences and humanities. These courses allow students to assimilate a beginning knowledge base in architecture and engineering along with a broader liberal based component to their education. Students who demonstrate proficiency in this portion of the program by meeting a specific set of admission criteria are eligible for admission to the professional program in architectural engineering.

The professional program in architectural engineering (typically three years) builds systematically upon the scientific and architectural knowledge acquired in the preprofessional curriculum. Students acquire detailed structural and architectural knowledge and problem-solving abilities through a series of progressively more detailed and comprehensive courses and studios.

Each architectural engineering course builds upon the preceding architectural engineering courses to develop in the student the ability to identify and solve meaningful architectural engineering problems. The course work is specifically sequenced and interrelated to provide design experience at each level, leading to progressively more complex, open-ended problems. (See the publication *Undergraduate Programs and Requirements*.) This course work includes sensitizing students to socially-related technical problems and their responsibilities as engineering professionals to behave ethically and protect public safety. The program culminates in a fifth year course in which the students integrate analysis, synthesis and other abilities they have developed throughout the earlier portions of their study into a capstone experience.

An integral part of this educational continuum from basic knowledge through comprehensive architectural engineering design are learning experiences that facilitate the students' abilities to function effectively in both individual and team environments. Students are exposed to a wide variety of problems dealing with contemporary issues in an international context. Moreover, the program provides every graduate with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational and CAD tools are introduced and used as a part of the students' problem-solving experiences. Finally, the students' experiences in solving ever-more-challenging problems gives them the ability to continue to learn independently throughout their professional careers.

Undergraduate Curriculum

The programs in architecture and architectural engineering are five years long and offer the professional degrees of Bachelor of Architecture and Bachelor of Architectural Engineering.

Undergraduate Admission. Students who satisfy the University admission requirements are eligible to enroll for the first two years of the program (pre-architecture). Upon completion of these two years, the best qualified students are selected, upon application, by the School for admission to the upper division. Admission is based upon academic achievement and professional potential. Admission criteria are subject to annual review by the School and may be obtained directly from the School.

Transfer students are required to furnish transcripts and course descriptions for previous classroom courses, as well as examples of previous studio work. Evaluation and enrollment by the School is on a course-by-course basis for all transfer students.

General Education. At least 12 semester hours of basic science and mathematics can be counted toward General Education requirements, and some required upper-division course work in History and Theory of Architecture can be used for General Education credit.

Electives. Electives should be selected to comply with the appropriate undergraduate degree requirements for the program. (See "Changes in Degree Requirements" in the "Academic Regulations" section of the *Catalog*.) These requirements assure compliance with institutional and accreditation criteria.

Foreign Study. The School of Architecture is committed to preparing its

graduates for the professional opportunities presented by the expanding global economy. As part of this preparation, the School offers a nine-week Summer Foreign Study Program based in Versailles, France. This program has been designed to supplement the required curriculum. Students study, in an organized and disciplined fashion, major examples of modern and historic European architecture including urban issues. Both analytic and artistic sketching skills are the main tools developed in this course of study.

Experience has shown that the Summer Foreign Program significantly increases a student's level of maturity, independent thinking, and cultural and social awareness of others. Knowing the values and accomplishments of other cultures not only deepens and broadens knowledge and abilities, it also makes a student a better and more responsible citizen of his or her own country.

Five weeks of the nine-week program are spent in France under the direct supervision and instruction of faculty from OSU. The remainder of the nine weeks is spent in independent travel study in other countries in western and central Europe. Housing while in Versailles is provided in French family homes, enriching the cultural experience of each student.

Faculty and Facilities. In keeping with the professional orientation of the School, the faculty have extensive experience as successful practicing architects and architectural engineers, as well as outstanding scholastic records.

The School of Architecture is housed in the Architecture Building, the original University Gymnasium and Armory, built in 1918. This structure was extensively remodeled in 1976 and contains all studios, laboratories, galleries and offices of the School. Specialized facilities include the Cunningham Library, containing all of the University's holdings on architecture and a fully-equipped Computer-assisted Design Laboratory. The faculty and students are especially proud of the Architecture Building, for it serves as an example of innovative architectural design and the adaptive reuse of an important building.

Student Work. Projects submitted for regular class assignments may be retained by the School. All projects not retained will be available to the student.

Student Body. With the curriculum based upon extensive and personalized student-faculty interaction, the student-faculty ratio in studio courses is set at approximately 15 to one. Annual student enrollment is approximately 300 students of whom approximately 22 percent are women, and approximately 18 percent are international students, thus providing a rich and diverse educational environment. A variety of student organizations and activities are available.

Academic Advising

The College's Office of Student Academic Services provides advisement for all pre-architecture students. When a student has gained admission to the upper-division of architecture, he or she will be assigned a faculty adviser.

Each student is personally advised in the planning and scheduling of his or her course work and is counseled and advised individually on matters of career choice, his or her activities at OSU, and on other academic matters. An academic file is created for each student at the time of initial enrollment.

Graduate Programs

The School offers the opportunity for specialized study at the graduate level in architecture and architectural engineering. These programs lead to the post-professional degrees, Master of Architecture and Master of Architectural Engineering.

These graduate programs are designed for students already possessing their first professional or five-year degree. Each graduate program is normally one-year long and consists of a minimum of 32 credit hours.

Candidates with nonprofessional four-year undergraduate degrees may apply for admission to the professional degree program and, if admitted, complete the requirements for a Bachelor of Architecture degree. Application may then be made to the School's graduate program.

Graduate Admission. Admission is limited and based upon undergraduate academic records and accomplishments, examples of work, practical experience and recommendations from practicing architects, engineers and educators.

Admission depends upon being accepted by the Graduate College of the University and by the School's Graduate Admissions Committee. Complete applications for admission must be filed with both the Graduate College and the School by February 15. The School's Graduate Admissions Committee will review all applications by March 31. Late applications will be considered only if vacancies exist. Normally, applications to the graduate program are considered for admission beginning the following fall semester only.

Student Portfolios. For the Master of Architecture program, photographic examples of work performed in architectural design and other professional courses or actual practice are to be submitted with the admissions application for review by the School. Slides are not acceptable. Portfolios should be mailed directly to the School to arrive no later than February 15. Candidates for admission to the Master of Architectural Engineering program are not required to submit a portfolio.

Regulations and Procedures. Regulations and procedures as established by the Graduate College for a master's degree apply to the School's graduate programs, except as otherwise noted in the School's current program description. This description is reviewed by the School annually, and may be obtained directly from the School.

For further information, contact the School of Architecture, Oklahoma State University, Stillwater, OK 74078-1085.

Division of Engineering Technology

Professor and Director James E. Bose, Ph.D., P.E.

Engineering technology education is concerned with the practical application of engineering achievement with emphasis upon the end product rather than the conceptual process. Whereas the development of new methods is the mark of the engineer, effective use of established methods is the mark of the technologist. Often the technologist will be expected to achieve what the engineer conceives.

Curricula

Engineering technology curricula at OSU are four-year programs which lead to the Bachelor of Science in Engineering Technology. Graduates of the program are known as "technologists" and are trained either to assist engineers or to provide independent support for engineering activities. The technologist receives an intensive education in his or her technical specialty and great depth in mathematics and technical sciences. The program provides breadth in related technical, communication and socio-humanistic studies. A "master of detail," he or she is capable of independent action in performance of technical activities and is frequently involved as a coordinator, expediter or supervisor of other technical personnel. His or her capability in technical sales and other public-

contact positions is enhanced by his or her background in selected liberal studies.

Bachelor of Science in Engineering Technology Degree Programs

Construction Management

Electrical Engineering

Fire Protection and Safety

Mechanical Engineering

The Bachelor of Science in Engineering Technology degree requires either 124, 128 or 129 credit hours.

Engineering technology prepares graduates who:

1. Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines
2. Apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.
3. Conduct, analyze and interpret experiments and apply experimental results to improve processes.
4. Apply creativity in the design of systems, components or processes appropriate to program objectives.
5. Function effectively on teams.
6. Identify, analyze and solve technical problems.
7. Communicate effectively.
8. Recognize the need for and possess the ability to pursue lifelong learning.
9. Understand professional, ethical and social responsibilities.
10. Recognize contemporary professional, societal and global issues and are aware of and respect diversity.
11. Have a commitment to quality, timeliness and continuous improvement.

The engineering technology graduate is qualified to select from a broad array of engineering-related positions. Job titles of engineering technology graduates include field engineer, test engineer, associate engineer, product engineer, sales engineer, tool designer, production engineer, engineering technologist, estimator, scheduler, and project engineer.

Those less intrigued with theoretical concepts but who have the interest and aptitude toward applications are likely engineering technology majors. These students particularly appreciate the engagement of technical specialty courses beginning with the first semester and continuing throughout the course of study. The relevance of the technical science and related technical courses adds further satisfaction.

The Bachelor of Science in Engineering Technology program is composed of the following curricular subdivisions:

Mathematics and science—algebra, trigonometry, applied calculus, general physics, and chemistry or other science.

Technical specialty—technical science and related technical courses.

Communication—English composition, and written and oral technical communication.

Social sciences and humanities—history, government, religion, literature, art, music.

Electives—controlled and general.

Co-op Program. The College of Engineering, Architecture and Technology offers an experience-based program, Cooperative Education (Co-op). Co-op allows technology students to achieve a balanced education through the combination of theoretical and practical knowledge during their early years of professional development. The student's education is a cooperative effort between the University and industry. Students alternate semesters on campus with work semesters in industry during their junior and senior years. The periods of employment constitute an essential element in the educational process. Students gain practical knowledge which is carried back to the classroom, giving academic programs a sense of reality. By the time they receive their degrees, students have accumulated the equivalent of a year-and-a-half of progressively challenging work experience.

Participation in Co-op is voluntary; transfer students must successfully complete at least one semester at OSU prior to their first placement. Students may obtain further information about the program from the coordinator, 101A Engineering North.

Transfer Students

An important, contemporary educational development is the "two-plus-two" bachelor's program. Those completing an associate degree in technology-oriented curricula at other institutions are generally admissible to the junior year with a minimum loss of academic time. The "two-plus-two" concept provides the attractive feature of two occupational-entry levels—technician or technologist.

Required course work in mathematics and basic science is utilized to meet up to 18 semester hours of General Education requirements also. The Scientific Investigation requirement is met as a part of the course work meeting professional requirements for basic science.

Construction Management Technology

Associate Professor and Head
Charles A. Rich, M.S., P.E.

The construction industry is the largest industry in the world. Leadership in this field requires a broad knowledge of labor, materials, equipment, capital and construction procedures. The interdisciplinary approach of the construction management program offers the student specialized course work in all phases of construction, designed to prepare him or her for responsible positions in industry.

One of the primary goals of the Department of Construction Management is to enhance the quality of the instructional program through effective management of the curriculum, teaching assignments and fiscal and physical resources. This goal includes providing instructional facilities, equipment and support services for faculty and students which maintain an excellent learning environment.

Faculty with excellent credentials, including a balance of formal education, teaching ability and appropriate industry experience, are recruited nationwide and are provided opportunities for individual professional development and regular contact with the industry. Faculty members are encouraged to become involved in extension and research programs relating to the department's areas of strength or growth and to serve the needs for continuing education within the industry, particularly in the southwestern construction community.

These needs and opportunities for service are assessed regularly through close cooperation with local and regional construction professionals and industry associations. An active Industry Advisory Committee, representing a broad cross-section of the industry, meets regularly to offer support and guidance necessary to preserve uncompromising excellence.

The bachelor's program in construction management technology is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, phone: 410-347-7700, electronic mail: *accreditation@abet.org*. The educational objectives of the Department of Construction Management Technology are consistent with those required by TAC of ABET and are listed under "Division of Engineering Technology" in the *Catalog*.

The modern constructor must have a great deal of technical knowledge to keep abreast of rapidly changing equipment, materials and methods of construction. Specialized courses in estimating, surveying, structures, construction planning and scheduling, construction law and insurance, field and office management and construction procedures provide students with the background necessary for today's construction industry. These specialized courses, in addition to a blend of the basic sciences, business, and general studies, produce a well-balanced curriculum for students in construction. Special attention is given to computer applications in construction estimating, and the development of graphic, written and oral communication skills is emphasized throughout the curriculum.

Students with an interest in building structures may select courses in the "building" option of construction management which provides them with a knowledge of working drawings, mechanical and electrical equipment of buildings, and other course work for a career in building construction.

Students with an interest in civil engineering structures may select courses in the "heavy" option of construction management which provides them with a knowledge of highways, soils, foundations and other course work for a career in the heavy and industrial construction industry.

The department attempts to identify and recruit highly qualified students who will benefit from the instructional program, and faculty members promote retention and ultimate graduation of construction management students through effective instruction and advisement. An active program of outcome assessment among graduates and their employers assures that the program continues to provide the academic training required for success. As one method of program assessment, each student, in the final semester, is expected to sit for the Level I Constructor Qualification Examination given once each semester. The student is responsible for the application process, including the appropriate fees. The test fee is reimbursed to the student through the Office of University Assessment upon completion of the examination.

Graduates of construction management have shown the curriculum to be successful in their development as productive members of the construction industry, holding responsible positions as project managers, estimators, material and equipment salespersons, and construction managers at all levels.

Electrical Engineering Technology

Professor and Head
Thomas G. Bertenshaw, Ed.D., P.E.

The electrical engineering technology curriculum provides preparation for outstanding career opportunities not only in the electronics industry itself but also in many other areas in modern industry which depend upon electronics for control, communications or computation. Many opportunities exist for graduates to work in diverse areas of electronics and computers.

The work of the electrical engineering technology graduate may range from assisting in the design and development of new equipment in the laboratory, applying modern microprocessors in the field, to the operation or supervision of production operations, technical writing, customer service and sales.

The program provides the Bachelor of Science in Engineering Technology degree with an electronics major. To meet these diverse needs the program is laboratory-oriented and provides a strong foundation of mathematics and science, specialized course work in electronics technology and related technical areas, and courses in the area of communications and the social studies.

The electrical engineering technology–computer option curriculum provides the preparation for graduates to enter the growing field of computer hardware and software. The demand for graduates having both computer hardware and software skills is quickly developing as the importance of automation, robotics, and artificial intelligence is recognized. Graduates of this program will be prepared for those opportunities in industry requiring considerable knowledge of both computer hardware and software.

The program provides the Bachelor of Science in Engineering Technology degree with an electronics major, and with a computer option. To meet the diverse needs that graduates will have, the program provides a strong foundation of mathematics, science, and specialized courses. Related courses in the humanities and social sciences are included to give the graduate an appreciation of the world in which the graduate will live and work.

The bachelor's program in the electronics major is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET).

Fire Protection and Safety Technology

Associate Professor and Head
Thomas Woodford, M.S.

The fire protection and safety curriculum provides preparation for assessing and reducing the loss potential in the industrial setting with respect to fire, safety, industrial hygiene, and hazardous material accidents. With respect to fire, reducing the loss potential might involve setting design criteria with a special emphasis on life safety or fire resistivity or specifying automatic detection or extinguishing systems. When considering safety, reducing accidents may require special protective equipment or clothing, or the redesign of machinery or processes. Reducing losses caused by environmental problems may require sampling air for contaminants, such as asbestos or toxic chemicals, or monitoring noise levels, and the development of procedures to address practical approaches to compliance with state and federal regulations. Addressing the problems of handling and disposing of hazardous chemicals, such as spill control, is often required. Managing risk and compliance with federal laws and regulations relative to occupational safety and health and hazardous materials is an increasingly important job activity.

The fire protection and safety engineering technology program has existed at Oklahoma State University since 1937. The demand by business and industry for loss control specialists has resulted in the evolution of the program into one that now places emphasis upon industrial fire protection, safety, and occupational health. The program is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET) and concludes with the Bachelor of Science in Engineering Technology degree in fire protection and safety.

The curriculum is designed to immediately introduce the student to studies in fire protection and safety. Therefore, students are able to measure their interest in a fire protection and safety career early in their academic program. The curriculum is rigorous in the areas of mathematics and the physical sciences. Two semesters of calculus are required as well as two semesters of chemistry and one semester of physics. Computer usage is an essential component of most fire protection and safety courses. Interested high school students should design their high school programs to prepare themselves for college level mathematics and science classes.

The graduates of the fire protection and safety engineering technology program at Oklahoma State University are consistently recruited by the major businesses and industries of the United States. Graduate placement, salary offers, and advancement into managerial positions have been excellent due to the uniqueness and high technical quality of the OSU fire protection and safety technology program.

Mechanical Engineering Technology

Professor and Head
James E. Bose, Ph.D., P.E.

Mechanical engineering technology (MET) is that component of engineering that specializes in design and application. It includes the broad areas of mechanical design, mechanical power and manufacturing. Mechanical engineering technology is applied in robotics, automotive manufacturing, computer-aided drafting and design, computer-aided manufacturing, agricultural machinery and processing, mining, shipbuilding, spacecraft, electronics manufacturing, food processing, aircraft metals and plastics production—nearly the entire spectrum of the industry. In the power areas MET graduates are involved in vapor power cycles, gas power cycles, air conditioning, fluid power and power transmission. Manufacturing areas involving MET graduates include tool design, cost evaluation and control, plant operations, production planning and manufacturing methods.

An important element in MET is the use of laboratory experience as a teaching tool. The MET program has laboratories in fluid power, materials, fluid mechanics and applied thermal sciences, basic instrumentation, computer-aided design (CAD), and manufacturing. A senior capstone design course composed of student teams integrates the kowledge and skills learned during their course of study. These laboratories are supported with the latest computer software that supports the design function. Where appropriate, laboratories with modern computer data acquisition systems and on-screen displays are available.

In addition to the required mechanical engineering technology courses, students are provided a solid foundation in algebra, trigonometry and calculus, physics, chemistry, statics, dynamics, instrumentation, thermodynamics and computer science.

Preparation for a specific industrial function can be accomplished by selecting courses that emphasize a given design area, such as fluid power, mechanical design, computer-aided design (CAD) power generation, and air conditioning and heating. Because the program focuses on the application of engineering principles to the pragmatic solution of problems, graduates are immediately productive with minimal on-the-job training, thus increasing their value to industry. Graduates of the MET program are prepared to function in the areas of product design, testing, and evaluation; product application and maintenance field engineering; and technical sales and liaison. Industries employing MET graduates include manufacturing companies of all types, (aircraft, automobile, compressor and turbine, fluid power manufacturers and others); energy companies (such as natural gas, electrical power generation, and the oil and gas industries); and service companies (transportation industry, architecture and professional engineering firms, and those supporting the oil and gas industry).

Companies utilizing the talents of MET graduates are diversified in their products, as well as geographical location, thus providing a variety of choices in respect to both type of work and place of residence and in diverse industrial, governmental and educational institutions.