College of Engineering, Architecture and Technology

College Administration

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The vision of the College of Engineering, Architecture and Technology (CEAT) is To be the leading public university in engineering, architecture, and technology that engages diverse students, faculty and staff with industry and government to deliver excellence in advanced learning, leadership, relevant research, and benefits to society.

Our mission is to provide a diverse population with a quality education in engineering, architecture and technology. Through CEAT, OSU develops ethical leaders who promote economic and community vitality with technical knowledge, innovation, and communication expertise that connects scientific research, professional education, technical assistance and scholarship to industry, the State of Oklahoma, the nation and the world.

The College of Engineering, Architecture and Technology is a community of scholars, innovators and leaders that is transforming our lives. The preparation of professionals that anticipate the needs of a changing world is at the nexus of society, economy, ethics, sustainability and humanity. The College is committed to training professionals that innovate, design and build projects that provide solutions for both the developed and the developing world.

The mission of the College of Engineering, Architecture and Technology (CEAT) is one that embraces students from diverse backgrounds to imagine and discover the challenges of engineering, architecture and technology, and to bring about innovation using their proficiency in science, mathematics, communications, ethics and humanity. This mission is built on the foundation of the University's mission and the expectations of a world class university.

As Oklahoma's land-grant university, CEAT fulfills the most fundamental premise that founded OSU; to promote economic and community viability through technical assistance, academic and professional education, training and communication in the areas of engineering, architecture and technology, and by connecting scientific research and scholarship to industry, communities, and individual citizens in Oklahoma, the region and the world.

As we progress into the future, professionals with a higher education will continue to be largely responsible for shaping our world. The power they exercise is an exciting prospect and presents a sobering responsibility. Less complex problems have been solved and are now a part of history. Many difficult problems remain. The need for talented and highly trained professionals is obvious; one will be embarking on a lifetime of challenge as he or she prepares for a career in engineering, engineering technology or architecture at Oklahoma State University.

The College of Engineering, Architecture and Technology offers a complete spectrum of educational opportunities designed to give graduates the capability and flexibility to meet the ever-changing needs of a society that is committed to technological innovation. To make continuing contributions, engineers, architects and technologists must have many abilities at their command. The modern tools and processes of industry must be understood. The processes of design and analysis require a firm understanding of mathematics and the sciences. An effective engineer, architect or engineering technologist must develop sensitivity to human needs, ideas, institutions and cultures. These programs prepare graduates to be effective contributors within human organizations and provide an increased understanding of both the technical and non-technical factors that shape our human environment. With this firm foundation, and a commitment to lifelong learning, College of Engineering, Architecture and Technology graduates are fully prepared to make contributions to society throughout their professional careers.

The curriculum in each program provides the optimum combination of breadth in the enduring fundamentals and specialization in a discipline. Each curriculum sensitizes the student to ethical, social, cultural and global issues that will shape their ideas and contributions. To equip the student to contribute to solutions at the cutting edge of technology, curricula are continuously evolving to include current applications of the principles. Through the combination of theory, practice and improved sensitivity to diverse issues, graduates will be prepared to support their diverse interests while positively contributing to the advancement of technology and the world.

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 biomechanical, bioprocessing and food processing, environment and natural resources; Chemical Engineering with options in environmental, biomedical/biochemical and premedical; Civil Engineering with an option in environmental; Computer Engineering; Electrical Engineering; Industrial Engineering and Management; and Mechanical Engineering with options in premedical.

Master of Science in Biosystems Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering with options in Control Systems and Optics and Photonics, Engineering and Technology Management, Environmental Engineering, Industrial Engineering and Management, and Mechanical and Aerospace Engineering with an option of Unmanned Aerial Systems.

Doctor of Philosophy in Biosystems Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering and Management, and Mechanical and Aerospace Engineering.

School of Architecture:

Bachelor of Architecture, Bachelor of Architectural Engineering.

Division of Engineering Technology:

Bachelor of Science in Engineering Technology in Construction Management Technology with options in building and heavy, Electrical Engineering Technology with a computer option, Fire Protection and Safety Engineering Technology, and Mechanical Engineering Technology.

Accreditation

Undergraduate engineering programs are separately accredited by the Engineering Accreditation Commission of the ABET, **http://www.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, Inc., phone 202.783.2007.

The undergraduate engineering technology programs are separately accredited by the Engineering Technology Accreditation Commission of ABET, **http://www.abet.org**. Specifics of accreditation are found in the program descriptions in the section "Division of Engineering Technology."

Special College Programs

Cooperative Education Program (Co-op) provides an avenue for undergraduate students to complete a year of full-time work experience directly related to their academic studies. Co-op students alternate terms of major-related employment with terms of full-time course work to achieve a quality education and industry experience. In addition to professional development, participation in the Co-op program earns academic credit and maintains full-time enrollment status for students during the work experience terms.

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

CEAT Freshman Research Scholars Program provides opportunities for accelerated intellectual development of a select group of students. Each student is assigned a research faculty mentor and participates in a research program. The initial assignment is for one year and it may be extended based on student interest, research project continuation and mentor availability.

Career Services. The Career Services Office for the College of Engineering, Architecture and Technology is dedicated to helping students reach their career goals. CEAT Career Services provides individualized career assistance, specialized workshops, and resources on a variety of topics including: career exploration, job search strategies, resume and job search correspondence preparation, interviewing skills, and salary negotiation. The office also supports the Cooperative Education Program (Co-op) and provides individual career assessments for undergraduate students. As part of the OSU Career Services system, CEAT Career Services works in close partnership with CEAT Student Academic Services to link academic and career success.

CEAT Living Unit Programs. CEAT residential floors have been established in the Allen Residence Halls for both male and female CEAT students. Living/Learning Communities provide an atmosphere that is conducive to study, the students experience a community where they can work together, have access to tutoring, and serve as role models for other students. Special activities are planned for the floors, including events with faculty and other leaders.

Departmental Clubs and Honor Societies

Alpha Epsilon (Biosystems and Agricultural Engineering Honor Society)
Alpha Pi Mu (Industrial Engineering and Management Honor Society)
Alpha Rho Chi (Architecture Honor Society)
Amateur Radio Club - W5YJ
American Indian Science and Engineering Society
American Institute of Architecture Students
American Institute of Aeronautics & Astronautics
American Institute of Chemical Engineers
American Society for Quality
American Society of Agricultural and Biological Engineers
American Society of Civil Engineers
American Society of Heating, Refrigeration and Air Conditioning Engineers
American Society of Mechanical Engineers: International
American Society of Safety Engineers
Architectural Engineering Institute
Architecture Students Teaching Elementary Kids (ASTEK)
CEAT Student Council
Chi Epsilon (Civil and Architectural Engineering Honor Society)
Construction Management Society
Construction Specifications Institute
Cowboy Motorsports Quarter Scale Tractor Team
Engineers Without Borders
Eta Kappa Nu (Electrical and Computer Engineering Honor Society)
Fire Protection Society
Institute for Operations Research and the Management Sciences
Institute of Electrical and Electronics Engineers (two student branches)
Institute of Industrial Engineers
Institute of Transportation Engineers
International Fluid Power Society
International Society for Automation
Omega Chi Epsilon (Chemical Engineering Honor Society)
Pi Tau Sigma (Honorary Mechanical Engineering Society)
Sigma Gamma Tau (Honorary Aerospace Engineering Society)
Sigma Lambda Chi (Construction Management Technology Honor Society)
Society of Automotive Engineers
Society of Automotive Engineers Formula Racing Team
Society of Automotive Engineers Mini-Baja Team
Society of Black Engineers, Technologists & Architects
Society of Fire Protection Engineers
Society of Hispanic Professional Engineers
Society of Manufacturing Engineers
Society of Women Engineers
Student Association of Fire Investigators
Student Firefighter Combat Challenge Team
Tau Alpha Pi (Technology Student's Honor Society)
Tau Beta Pi (Engineering Student's Honor Society)

CEAT Honors Program

The OSU Honors College provides challenges for undergraduate students of unusually high ability, motivation and initiative. Honors classes, seminars and independent study courses are designed to align students and instructors in a manner that encourages discussion and provides 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 OSU Honors College requirements.

Information regarding The Honors College at OSU, and Scholar Development/Leadership Programs can be found in the *Catalog*, in the *Academic Enrichment Programs* section.

Scholarships

Several CEAT scholarships are funded through the generosity of alumni, private, and corporate donations. Awards are available for undergraduate students at all levels, and are granted on the basis of academic achievement, campus involvement and leadership potential, as well as financial need.

Freshmen and undergraduate transfer students are automatically considered for CEAT scholarships through their applications for admission to OSU. For full scholarship consideration, students should apply for admission by February 1st priority deadline.

Current undergraduate (continuing) students should submit applications for general CEAT scholarships online at **http://www.ceat.okstate.edu/scholarships**. Students should also check with their individual departments for information regarding scholarships specific to their majors.

High School Preparation

In addition to the curricular requirements for admission specified by OSU, the College of Engineering, Architecture and Technology strongly recommends that students have a fourth year of mathematics and an additional year of laboratory science.

General Education Requirements

For students in Engineering, Architecture and Technology, courses in the humanities and social sciences provide both a broad education and essential background for addressing the critical issues of society. Students in the College must take General Education courses consistent with those specified on the degree requirement sheet. Each student should visit with his or her adviser to ascertain that appropriate courses are being selected. Students in some programs are required to complete a course in technical report writing. 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 specific program requirements. See Academic Regulations 3.5 for further details.

Computing Requirements

For students in Engineering, Architecture and Technology, the college requires that all students have several basic tools. Students in the College must have a scientific calculator and a laptop computer. The scientific calculator should be capable of computing trigonomic functions, logarithmic and natural logarithmic functions, basic statistical analysis, and all algebraic functions. The laptop requirements are published on the college IT website **http://ceat-its.okstate.edu.**

Schools of Engineering

Each of the schools of engineering offer Bachelor of Science, Master of Science, and Doctor of Philosophy degree programs. 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 *University Catalog*.

The common curricular objectives for the engineering programs are to develop each student's: (1) capability to delineate and solve the engineering problems of society in a practical way, (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.

Class Placement

Initial placement in OSU mathematics courses is by placement examination to ensure that each student will be challenged, but has the preparation to be successful in the first mathematics course. Placement in science courses is based on prior preparation in the science and completion of or placement beyond prerequisite mathematics courses. When appropriate, a student with an exceptionally 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 engineering pre-professional school students. . At the time of admission to Professional School, typically in the third year of studies, he or she will be assigned a faculty adviser in the school of their major (within the college).

Each student is personally advised in the planning and scheduling of his or her course work, assisted with the selection of a major, and is counseled and advised individually on matters of career choice, activities at OSU, and on other academic matters.

Each student, and his or her adviser, carefully selects general education, core engineering, and 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. An introduction to the engineering field and the majors available in the college, is presented in ENGR 1111. In this student development course, students will also learn how to be successful as engineering students and will be well informed of the many resources that are available on campus to promote their success.

To assist students in planning and mapping their academic success, an electronic account is created for each student at the time of initial enrollment. Students have access to their personal account, via the STAR System, where they can review their advising materials, degree sheet, flowchart and other documents. The adviser assists the student with academic decisions and works to ensure accuracy and compliance; however, the ultimate responsibility for meeting degree requirements rests with the student.

The Engineering Professional School Concept

A student entering OSU is admitted into the pre-professional school program and will complete course work that is typically taken during the first two years of an engineering curriculum. Near the completion of this course work, the student is considered for admission to one of the engineering professional schools of the College to continue in the upper-division program. After satisfying admission standards, the student is then permitted to pursue a curriculum leading to the Bachelor of Science degree in his or her discipline.

Pre-Professional School. In each school of engineering, lower-division course work is devoted to preparing the student for professional school. The content of the pre-professional school program is similar for most engineering specialties and includes English composition and technical course work devoted to mathematics through calculus and differential equations, general chemistry, general physics, engineering and engineering sciences.

Transfer students will be admitted directly to pre-professional 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.

Regardless of previous background, all new engineering students must enroll in ENGR 1111, BAE 1012 (if the student plans to study biosystems engineering), or ARCH 1112 (if the student plans to study architectural engineering). New students who do not have a strong preparation in mathematics and science will be required to complete additional course work before enrolling in required courses in these subjects. Students transferring to pre-professional 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.

Students not directly admissible to pre-professional school, but those who meet OSU requirements for admission, may be admitted to the university's Learning and Student Success Opportunity (LASSO) Center, where they will be advised for two or three semesters. Students interested in transferring from the LASSO Center to CEAT must meet academic requirements as documented by CEAT and filed in the LASSO Center.

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

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 in the right column on the degree requirement sheet. Degree requirement sheets can be found in the university's publication of *Undergraduate Programs and Requirements*, available online. Upon completion of all degree requirements, the student is awarded the Bachelor of Science degree.

Engineering Professional School Admission Requirements

All undergraduate engineering students must follow the curriculum and requirements for their chosen engineering major, as prescribed in the university's publication of *Undergraduate Programs and Requirements*, for their matriculation date, or upon their election, a later annual version of that publication. Students are encouraged to carefully read the program requirements for their chosen major and matriculation date.

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

1. Complete a minimum of 60 credit hours of courses listed on the degree requirement sheet from an accredited institution of higher learning.
2. Complete all required (shaded) courses on the degree requirement sheet.
3. Earn a grade of "C" or better in technical courses required for the degree and taken prior to admission to professional school. In these courses, meet or exceed the **Technical GPA** requirement listed in the *Departmental GPA Requirements* section below (when applicable).

   Note: Technical courses include astronomy, biology, biochemistry, chemistry, geology, engineering (BAE, CHE, CIVE, IEM, ECEN, ENGR, ENSC, MAE), math, physics, statistics, zoology, and any additional science courses listed on the degree requirement sheet.
4. Complete a minimum of 12 credit hours of courses at OSU, required for the degree. In these courses, meet or exceed the **OSU GPA** requirement listed in the *Departmental GPA Requirements* section below (when applicable).
5. Complete a minimum of 9 credit hours of technical courses at OSU, required for the degree. In these courses, meet or exceed the **OSU Technical GPA** (all technical courses required for the degree taken at OSU) listed in the *Departmental GPA Requirements* section below (when applicable).
6. Earn a final grade of "C" or better in all courses submitted to satisfy the University's English requirement.
7. Meet any additional requirements for the selected major, as specified below.
8. Demonstrate an acceptable level of academic competence in subject material comparable to that covered in pre-professional school as defined by the selected professional school below. Such demonstration may be by completion of course work or by examination with not more than half the requirements satisfied by examination.
9. Demonstrate an acceptable level of professional potential, including academic integrity and ethical behavior, as determined by the professional school head.

Departmental GPA Requirements

All specified GPAs are calculated based on the last grade earned in repeated courses. The minimum GPA requirements by school, and any additional requirements, are as follows:

a. School of Biosystems and Agricultural Engineering:
GPA Requirements for Professional School: Technical GPA-2.50, OSU GPA-2.50, OSU Technical GPA-2.50

b. School of Chemical Engineering:
GPA Requirements for Professional School: Technical GPA-2.70, OSU GPA-2.50, OSU Technical GPA-2.70. A final grade of "C" or better must be achieved in the required pre-professional courses(underlined on the degree requirement sheet). If a "C" is obtained in ENGL 1113 or 1313, ENGL 1213 or 1413 is also required.

c. School of Civil and Environmental Engineering:
GPA Requirements for Professional School: Technical GPA-2.50, OSU GPA-2.50, OSU Technical GPA-2.50, and a grade of "C" or better in each course that is a prerequisite for a CIVE course and in all required technical pre-professional courses (underlined on the degree requirement sheet) whether taken prior to professional school or not.

d. School of Electrical and Computer Engineering:
GPA Requirements for Professional School: Technical GPA-2.70, OSU GPA-2.60, OSU Technical GPA-2.70

e. School of Industrial Engineering and Management:
GPA Requirements for Professional School: Technical GPA-2.50, and a grade of "C" or better in each course that is a prerequisite for an IEM course and in all technical pre-professional courses (underlined on the degree requirement sheet) whether taken prior to professional school or not.

f. School of Mechanical and Aerospace Engineering:
GPA Requirements for Professional School: Technical GPA 3.0, OSU GPA3.0, OSU Technical GPA-3.0

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. However, enrollment preference in such courses will be given to students admitted to the professional school.

Biosystems and Agricultural Engineering

Daniel L. Thomas, PhD, PE—Professor and Head

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. Biosystems engineers directly address problems and opportunities related to food, water, energy, and the environment – all of which are critical to the quality of life in our society. Subject-matter specialization is provided through the following three undergraduate option areas: bioprocessing and food processing, environment and natural resources and biomechanical.

Biosystems engineering courses integrate engineering sciences, physical sciences, and biological sciences, and teach 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:

- establish themselves as practicing professionals able to understand, analyze, and solve real-world problems in food, agricultural, environmental, and/or biological systems.
- be effective in oral, written and visual communications as practicing professionals.
- be able to work successfully as a member of a professional team and function effectively as responsible professionals.
- be able to perform in a professional and ethical manner as a practicing professional.
- be committed to enhancing knowledge and skills through continuing education and actively participate in professional development activities.

The undergraduate educational program is divided into two components—pre-professional and professional. In the pre-professional 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 pre-professional 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 ABET (see www.abet.org) under criteria for biological 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, 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. The students have also developed and displayed the ability to conduct experiments essential to specific studies and to analyze the experimental results that lead to meaningful conclusions.

The biosystems engineering program verifies that our students possess core engineering knowledge and capability by requiring students to take the Fundamentals of Engineering exam, which is an important step toward becoming a professional engineer. All candidates for the BS degree in biosystems engineering must take the Fundamentals of Engineering exam prior to receiving their degree.

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. To achieve this, 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 utilized as a part of their problem-solving experiences. Finally, the students' experience 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 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 Department of Biosystems and Agricultural Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees in biosystems engineering. 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, food engineering, sensor and control technology, waste management and utilization, hydrology, water quality, porous media flow, and intelligent systems for agricultural machine design and production.

Research projects are supported by the Agricultural Experiment Station and by state, federal and private grants and contracts. Well-trained faculties, 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, manage the project to completion, and report the results through peer-reviewed papers and professional presentations.

Admission Requirements. Admission to either the Master of Science or Doctor of Philosophy degree program requires graduation from an engineering curriculum accredited by the Engineering Accreditation Commission of ABET (**www.abet.org**). 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

James R. (Rob) Whiteley, PhD—Hendrix Chair, Professor and Head

Chemical engineers use knowledge of how nature works (science) and the language of science (mathematics) to create value and solve difficult problems for the benefit of society. The key skill that differentiates chemical engineering from other disciplines is the ability to understand, design and operate transformation (physical or chemical) processes. Chemical engineers literally change (transform) the world. Many in the public assume chemical engineers work only in chemical plants and petroleum refineries. The reality is that chemical engineers work in a broad range of industries including pharmaceuticals, biochemicals, semiconductor materials, foods, plastics, paper, steel, consumer goods, automotive, specialty materials, oil & gas production, renewable energy, engineering services, and the list goes on. 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 molecular or 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 equipment to carry out the process. After the installation, chemical engineers commonly manage operations, oversee equipment maintenance, and supervise control of product quality. They trouble-shoot problems that hinder smooth operations, and they plan for future expansions or improvements. Their training and knowledge make them well qualified to market products and processing equipment. The varied background and experience of chemical engineers make them ideally suited for advancement into top-level managerial and executive positions. An advanced degree in chemical engineering is not required.

Many who aspire to careers in medicine or law first obtain BS degrees in chemical engineering. The rigor of the program and the emphasis on critical thinking and analytical reasoning are highly valued by professional school admission committees. A career as a research scientist or academic typically requires a PhD degree.

Program Educational Objectives. The School has three broad objectives. Within the first few years after graduation, our BS graduates will have demonstrated:

1. Competencies – skill in tools and techniques that are fundamental to the job - many of which need to be learned after graduation.

2. Professionalism – partnership in the mission and within the human context of the enterprise - ethics, effectiveness, and awareness of the broad context of the detailed work.

3. Balance – a wise self-direction to life, community, health, and self-view that finds the right balance between personal choices, which energizes self and others and enables effectiveness in relationships with others.

The goal of the BS 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 pre-professional 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 last two years) builds systematically upon the scientific knowledge acquired in the pre-professional 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 pre-medical option is for those who wish preparation for medical school; and (3) the biomedical/biochemical option is for those who seek employment in bio-related professions. Each emphasis area is accredited under the basic level EAC-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.

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, students 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.

Integral parts 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 collaborative environments. To achieve this, the program provides every student with adequate learning experiences to develop effective written and oral communication skills. State-of-the-art computational tools are introduced and utilized as a part of their problem-solving experiences. Finally, the students' experience in solving ever-more-challenging problems gives them the ability to continue to learn independently throughout their professional careers.

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 ABET or a recognized equivalent from any international program.

Students with related undergraduate degrees, such as chemistry, automation engineering, etc. can be admitted conditionally, subject to completing prescribed undergraduate Chemical Engineering program courses. Admission is competitive based on undergraduate GPA, GRE and TOEFL (for international students), statement of interests, experience and recommendations.

The Master of Science Degree. Two options are offered for this degree, Research-Oriented and Practice-Oriented options. General requirements for the Research-Oriented MS degree in chemical engineering are 30 credit hours of work beyond the BS 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 general requirements for the Practice-Oriented MS degree are 32 credit hours of work beyond the BS, including two hours of credit assigned to an acceptable technical report. For both options, 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 credit hours beyond the BS 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

John N. Veenstra, PhD, PE—Professor and Head

Civil engineers build the future. The exceptional diversity of professional practice in civil and environmental engineering presents many career opportunities for students.

The concern of civil engineers is infrastructure - the design, construction, management, alteration and utilization - which allows society to function. Civil engineers plan, design and construct, highways, waterway and railway systems, harbors and shipping facilities, systems for the treatment and distribution of water and for the collection and treatment of municipal and industrial waste, dams and hydroelectric works, airports and terminals, structures of every kind including buildings, bridges, towers, industrial plants, tunnels and subway systems, processes 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-professional courses in mathematics, physical sciences and engineering sciences. On this foundation, required courses equip the student with 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 practical solution of problems.

Educational Objectives. The Bachelor of Science in Civil Engineering degree program educates and prepares engineers who a few years after graduation will be:

1. Contributing to society through the practice of civil engineering in a variety of contexts, including the protection of public health and safety and the development of sustainable engineering solutions;
2. Effectively applying the technical knowledge, engineering principles, communication skills and personal attributes necessary to be adaptable and successful in the civil engineering profession;
3. Advancing within their profession, including attaining professional licensure and positions of leadership; and
4. Exhibiting life-long learning, including the pursuit of advanced degrees.

The curriculum is designed to enable students to satisfy the educational objectives in conjunction with the student outcomes. These outcomes state that graduates of the program will have: (a) an ability to apply knowledge of mathematics, science, and engineering, (b) an ability to design and conduct experiments, as well as to analyze and interpret data, (c) an ability to design systems, components, or processes to meet desired needs within realistic constraints (such as economic, environmental, social, political, ethical, health, safety, and sustainability), (d) an ability to function on multi-disciplinary teams, (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) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context, (i) a recognition of the need for, and an ability to engage in life-long learning, including an understanding of the importance of professional licensure, (j) a knowledge of contemporary issues, and (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The School provides a curriculum that is effective and balanced among the major areas of civil engineering practice. Design capabilities are developed throughout the curriculum, culminating in a comprehensive senior design experience, incorporating much of the previous course work. 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 option for those students wishing to concentrate more heavily in the environmental area of practice. Program curricula requirements are outlined in the publication *Undergraduate Program and Requirements*. The general civil option and the environmental option are accredited together by the Engineering Accreditation Commission of the ABET under the criteria for civil and similarly named engineering programs.

Southern Plains Transportation Center. Oklahoma State University, and seven other universities are members the Southern Plains Transportation Center (SPTC). The regional transportation center is a US DOT designated Region 6 University Transportation Center (UTC) and 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; and to enhance the transportation systems that touch the lives of the people of Oklahoma and the region.

Graduate Programs
The School of Civil and Environmental Engineering offers three programs leading to post-baccalaureate degrees— 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 Science degree is characterized by a technical specialization in a particular area of study. The Doctor of Philosophy degree is designed to prepare students for research and for the teaching profession in engineering.

Major areas of study in the School are applied mechanics, structural analysis, design, transportation, materials, construction engineering and management, geotechnical engineering, water resources, and environmental engineering. Research in all major fields is continuously pursued. Master of Science in 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 should have graduated from a civil engineering curriculum accredited by ABET. 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 credit hours beyond the bachelor's degree, including a research thesis for which no more than six credit hours may be granted. The non-thesis option (32 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 credit hours of course work beyond the bachelor's degree, including not more than 30 credit hours for the research thesis. In addition, the candidate must meet the equivalency of the language requirement (six hours) in selected areas at the discretion of his or her committee to facilitate his or her research. 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

Jeffrey L. Young, PhD, PE—Professor and Head

Electrical Engineering and Computer Engineering (ECE) are two related professional engineering disciplines that are responsible for the health, quality of life, and safety that we often take for granted. Engineers are creative problem solvers who make remarkable contributions to building and sustaining the society we enjoy today, while offering exciting opportunities for the future. One of the most exciting aspects of being an electrical engineer or computer engineer is that there is never just one way to solve an engineering design problem. Engineers use creativity, innovation, and expertise to design products and services that meet human needs, while staying within the constraints set by nature. A major difference between science and engineering is that scientists deal with the world that is, while engineers envision the world that could be. It is the job of the engineer to identify what people need or want and determine the best way to provide it.

Electrical Engineering deals with electricity, power, communications, electronics and photonics and the design of intelligent systems. Electrical engineers dream of the future and have the skills and talents to shape that future. As they use new technologies to provide new ways of seeing the world, while also bringing people together, electrical engineers develop the technologies that bring out the best in people. The power to light the darkness, the knowledge to know where you are on earth within fractions of a meter, the technologies to enhance healthcare, and the skills to communicate, not only across the state or globe, but with deep space satellites across distances of millions of Earths, have all been developed by electrical engineers.

Computer Engineering is a relatively young engineering discipline that combines a strong foundation in electrical engineering with elements of computer science, including hardware-software integration and software design, to deal with the many “digital” or computer-based systems and devices we encounter every day. Computer engineers and electrical engineers have many things in common. Computer engineers analyze, design, and develop computer-based systems and digital electronics, focusing on all aspects of computing, both hardware and software. Computer engineers understand digital logic design, computer architecture, digital data communications, computer and sensor interfacing, microprocessors, VLSI circuits and systems, operating and software systems, and computer arithmetic. Together, they apply this knowledge to solve important problems in diverse areas. The U.S. Department of Labor Statistics’ Occupational Handbook predicts that computer engineering is one of the three fastest growing occupations in the nation and is expected to grow much faster than most other occupations.

Electrical engineers and computer engineers are creative and innovative problem solvers that harness their creativity to develop many modern technologies and devices. The technologies that electrical engineers and computer engineers discover and develop have improved lives immeasurably, and future technologies will improve and change them even more. An undergraduate degree in electrical engineering or computer engineering provides the opportunity to make a difference in these exciting areas. From providing reliable power to millions across the United States, to designing microscopic tracking devices to better understand and protect endangered species, electrical engineers and computer engineers make a great impact on society.

Beyond creating technology, engineers of tomorrow must be aware of the social, economic, ethical and environmental impact of these technologies. They must also communicate effectively, possess excellent teamwork skills, and understand, perform, and complete the process of engineering design. The undergraduate programs in electrical engineering and computer engineering at Oklahoma State University equip graduates with these critical skills.

Program Educational Objectives. The skills and attitudes that will benefit computer engineers and electrical engineers are defined through the educational objectives of the program and reflect our expectations for our graduates after they enter their professional careers.

Graduates of Electrical Engineering and Computer Engineering at Oklahoma State University will:

- be widely employed across a range of disciplines and sub-disciplines in electrical engineering and computer engineering and will report the program provided the preparation needed to succeed in an engineering career.
- be able to succeed in obtaining a professional or graduate degree should they choose to.
- report that in their careers they can function on multidisciplinary teams, communicate effectively, and perform engineering design.
- follow ethical standards in their careers and engage in public and professional service activities and
- understand the impact of social, economic, or environmental factors on engineering practice.

Student Learning Outcomes. In support of achieving these Program Educational Objectives, The School has established Student Learning Outcomes that are regularly assessed and expected of all students upon completion of their chosen program in Electrical Engineering or Computer Engineering. These include

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(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) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

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

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The School of Electrical and Computer Engineering (ECE) offers a full range of undergraduate and graduate program choices. A degree in electrical engineering or computer engineering is an excellent foundation for 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 engineering and computer engineering programs at Oklahoma State University prepare each graduate for a life-long professional career. During the first two years, students complete a carefully designed pre-professional program consisting of mathematics, physical sciences, engineering sciences, introductory electrical and computer engineering courses, computer science, and selected courses in the humanities and social sciences. For the remaining years of the program, students concentrate on specific electrical engineering and/or computer engineering course work.

Students majoring in electrical engineering or computer engineering can expect to obtain the life enhancing skills needed by tomorrow’s professionals. These skills include:

- creative problem solving
- professional skills that will contribute to their success in the profession
- developing abilities that will allow them to help shape the future

For electrical engineering students, these skills are learned through our curriculum in five areas of specialization that enable students to tailor course choices in order to gain both a breadth of knowledge and a depth of understanding in their chosen area.

Computer engineering students learn these skills by focusing on their own challenging specialized curriculum, also designed to provide breadth and depth within the discipline. Opportunities to take specialized courses in areas including embedded systems, VLSI design, computer architecture, and software engineering are also provided.

By tailoring the program to align student interests with faculty strengths, faculty-student interaction is enhanced as students receive better academic and career guidance. All electrical engineering areas of specialization, as well as computer engineering, provide multiple engineering design experiences throughout professional school. In addition to laboratories devoted to research, separate instructional laboratories grant opportunities for hands-on experience in areas such as microcomputers, digital logic design, electronics, electrical machinery, networks, instrumentation, and electromagnetics. Laboratories also serve to emphasize concepts learned in the classroom while students participate in engineering design.

Engineering design laboratories require students to solve open-ended problems in a manner that demonstrates the students’ ability to apply fundamental concepts, creativity and imagination, to solve realistic problems of practical importance. These problems have several possible solutions, and students must choose an acceptable approach and demonstrate that the desired outcomes have been met.

The capstone design experience is a two-course sequence typically taken during the student’s last two semesters in the program. The courses integrate analysis, design, and other skills the students have developed during their course of study. Teamwork, communication skills, and the complete engineering design process, from problem definition to prototype, presentation and documentation, are emphasized. Student teams receive individual project mentoring from an appropriate faculty member who provides project management and supervision. The capstone experience concludes with a formal public design demonstration, oral presentation, and written documentation. The new ECE Design Commons, an advanced design laboratory available to all students in electrical engineering and computer engineering, provides state-of-

the-art capabilities for design, prototyping, testing and diagnostics of advanced hardware and software systems.

The BS degree in electrical engineering is accredited by the Engineering Accreditation Commission of ABET under the criteria for electrical, computer, and similarly named engineering programs. The BS degree in computer engineering is a relatively new degree program which first became available in 2008. This program is also accredited by the Engineering Accreditation Commission of ABET under the criteria for electrical, computer, and similarly named engineering programs.

Graduate Programs
The School of Electrical and Computer Engineering offers two graduate degrees, both in electrical engineering: Master of Science and Doctor of Philosophy. Specialized MS degree options in 1) control systems and 2) optics and photonics are also available, as are interdisciplinary graduate degrees in several specialties. These graduate degree programs are flexible in course selection and emphasis.

The Master of Science degree emphasizes advanced design, development, and research methods for high technology and is designed for students interested in careers in industry and government or who want to prepare for advanced study through the PhD. This degree incorporates additional advanced course work and on-campus creative activities that allow students to expand their knowledge in electrical and computer engineering, while including depth in one or more advanced areas.

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

Students may select course work and participate in research and design projects in the following areas:

- communication systems and networks;
- control systems;
- computer architecture and arithmetic;
- electromagnetics;
- microsystems and nanoengineering;
- photonics and electro-optics;
- digital signal, image, and video processing;
- very large scale integration (VLSI);
- energy and power;
- bioengineering.

Students may also select a multidisciplinary program that crosses departmental lines and emphasizes the application of electrical and computer engineering and systems theory to complex problems. These applications serve to promote the interaction of engineering systems and technology with social, economic and environmental processes. Multidisciplinary opportunities exist in control systems, biomedical engineering, photonics, and nanotechnology and materials.

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 or computer engineering curriculum accredited by the ABET qualifies the student for admission to the School of Electrical and Computer Engineering as a candidate for the advanced degrees offered. A recent GRE is required as part of the application.

Graduates from non-engineering fields such as mathematics, physics and computer science are also admitted to the School of Electrical and Computer Engineering MS and PhD graduate programs if an evaluation of their transcripts indicates they are prepared to succeed in graduate-level course work in electrical and computer 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 credit hours are required, including six hours credit for the thesis. If no thesis is written, 33 credit hours are required, including at least two hours that include an approved 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 30-33 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 and computer 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 several interdisciplinary degree programs. (See "Graduate Programs" under "Industrial Engineering and Management," and "Telecommunications Management" in the "Graduate College" section of the *Catalog*.)

Master of Science in Engineering Technology Management

Terry Collins, PhD—Director
Brenda L. Johnson, MS—Assistant Director

OSU's Master of Science in Engineering Technology Management is a rigorous degree program designed specifically for experienced engineers and scientists who are interested in accelerating their management careers. The curriculum combines academic coursework with the latest business practices and can be tailored to meet an individual student's needs. Managing today's global organizations requires a complex set of knowledge and skills. Effective planning, selection, implementation and management of technology, and the teams involved, is essential to the success of any business in today's time-critical, global markets. OSU-MSETM students learn to apply proven evaluation concepts and implementation strategies to fast moving, technical management decisions that make the difference in both career and business success. The MSETM program specifically addresses the real needs identified by industry leaders. The MSETM curriculum permits you to build a strong degree that directly addresses your needs and prepares you for the future. The degree consists of 32 credit hours. The MSETM program is provided by the OSU colleges of Engineering, Architecture and Technology; Arts and Sciences; and the Spears School of Business.

Admission Requirements. The guidelines for admission to the MSETM program are a bachelor's or higher degree, in engineering or the physical/mathematical sciences, with a 3.00 GPA, and at least four years employment in a technical field since graduation with a bachelor's degree. Applicants not meeting these standards may be granted provisional admission based upon their overall academic and professional practice history and accomplishments. Since many course assignments are integrated into current issues in the work environment, students must be managing or employed in a technical organization in order to be successful in the program. For this reason the program is not appropriate for full-time on-campus students. The MSETM student body is made up entirely of full-time employed, technical professionals who receive the courses through distance education technologies. An applicant must submit the following documents to the MSETM office: (1) an official OSU Application for Graduate Admission, (2) an official transcript of all academic work and degrees received, (3) an application fee ($40 domestic, $75 international), (4) MSETM program application, (5) a professional resume, 6) A statement of goals and objectives. International applicants must also submit official results of the TOEFL with a minimum score of 89 IBT Application instructions can be found online at **http://etm.okstate.edu**.

Industrial Engineering and Management

Sunderesh Heragu , PhD—Donald and Cathey Humphreys Chair, Professor and Head

Industrial engineering and management 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, outreach 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 learning and mentoring environments 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.

Educational Objectives and Outcomes. Objectives: Within a few years after graduation, Industrial Engineering program graduates will become professionals, managers or leaders in a wide variety of industries and apply discovery, problem solving, leadership, and management skills for the benefit of their organization and society at large.

Outcomes: 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, engineering management 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 within realistic constraints such as economic, environment, social, political, ethical, health and safety, manufacturability and sustainability.
- an ability to function on 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 economic, environmental 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, ergonomics and human factors, and energy and water management. A capstone design experience, working with a real-world organization, integrates classroom and lab work together in the senior year. Details regarding degree requirements are available in the Undergraduate Programs and Requirements publication.

The IE&M program is accredited by the Engineering Accreditation Commission of the ABET under the criteria for both industrial engineering and engineering management.

Each IE&M student, along with the faculty adviser, develops an individual plan of study that guides the student through the curriculum. 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 developed 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, the Institute for Operation Research and the Management Sciences, and the American Society for Quality. 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 **http://iem.okstate.edu** for more information.

Graduate Programs

The School of Industrial Engineering and Management offers graduate programs leading to the Master of Science Industrial Engineering and Management degree and the Doctor of Philosophy degree.

The Master of Science degree is characterized by a higher degree of technical specialization in a particular field of study (beyond a BS degree). This degree program is designed to prepare students for professional practice that may include research or consulting components. The Master of Science degree is especially attractive to industrial engineering graduates, engineering graduates from other disciplines, and many science majors. The MS degree includes a strong technical component and an orientation to business and engineering management that is complementary to a technical background.

The Doctor of Philosophy degree is designed to position the student on the leading edge of knowledge in the profession of industrial engineering and engineering 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 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 engineering management, manufacturing systems, operations research, quality and reliability, facilities and energy-management, and enterprise systems 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 MS or PhD 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 doctorate degrees. Graduates from related disciplines 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 applicants must submit GRE scores (minimum 145 in Verbal Reasoning and 158 in Quantitative Reasoning). In addition, the Graduate College may require certain international applicants to submit TOEFL scores.

Degree Requirements. The Master of Science degree in industrial engineering and management requires the completion of at least 30 credit hours beyond the bachelor's degree, including a research thesis of six credit hours. A 33 semester-credit-hour option is also permitted and must include a three credit-hour creative component. The creative component requirement 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 credit hours beyond the bachelor's degree or 60 credit hours beyond the master's degree; including a minimum of 18 credit hours of dissertation research and a minimum of 30 credit hours of course work beyond the master's degree.

The School of Industrial Engineering and Management also participates in the Master of Science in Engineering and Technology Management program. Current IE&M program information can be found on the School website **http://iem.okstate.edu**.

Materials Science and Engineering

Raj N. Singh, PhD—Williams Company Distinguished Chair, Professor and Head

The field of materials science and engineering is expanding into a period of unprecedented intellectual challenges, opportunities and growth. Products created using materials science and engineering research contribute to the economic strength and security of not only the state, but also the country.

The School of Materials Science and Engineering is located at OSU-Tulsa's Helmerich Research Center, a premier facility which places the College of Engineering, Architecture and Technology in a unique position to conduct world-class education, research and technology development and transfer in advanced materials of strategic importance to our nation. Current research programs focus on materials for energy technologies, bio-materials for medical technologies, advanced materials for aerospace and defense, and materials for electronics and control technologies.

Program Educational Objectives. OSU is currently offering only a graduate program in Materials Science and Engineering:

Graduate Programs. The School of Materials Science and Engineering offers programs leading to the Master of Science and Doctor of Philosophy. The Master of Science program has been approved and the approval for the Doctor of Philosophy program is expected by fall 2014. 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.

At the Helmerich Advanced Technology Research Center (HRC) at OSU, four research focus areas have been identified by industry leaders in and around Tulsa, with Materials Science and Engineering (MS&E) as the overall umbrella. These focus areas include: Materials for Energy Technologies, Bio-Materials for Medical Technologies, Advanced Materials for Aerospace, and Materials for Electronics and Control Technologies.

Admission Requirements. Admission to either the Master of Science or Doctor of Philosophy degree program requires graduation from a materials science and engineering or related curriculum approved by the ABET or a recognized equivalent from any international program.

Students with related undergraduate degrees, such as chemistry, physics, engineering physics, applied physics, etc. can be admitted conditionally, subject to completing prescribed Materials Science and Engineering program core courses. Admission is competitive based on undergraduate GPA, GRE and TOEFL (for international students), statement of interests, experience and recommendations.

The Master of Science Degree. The M.S. degree in MS&E will have thesis and creative component (non-thesis) options. The thesis option will required a total of 30 credit hours, which includes 24 hours of formal coursework (regularly scheduled classes, not independent study) and 6 hours of thesis. The non-thesis option or creative component will require a total of 35 credit hours, which includes 33 hours of formal coursework (regularly scheduled classes, and not independent study) and 2 hours of creative component/project. The main difference between the two options is that in the thesis option, the student conducts independent research while in the creative component option, the student conducts critical review of the literature on an advanced topic of interest to the MS&E program. Both options require a professional report/thesis and an oral presentation. The student will take 15 hours of core courses (required) with the remainder of the hours being MS&E elective courses or their equivalent (to be approved by MS&E graduate coordinator and the student's advisor or has been considered as an equivalent MS&E course). The student must complete no less than 21 hours of MS&E 5000- and 6000-level courses through Oklahoma State University. For both options the courses taken must include: MSE 5013, MSE 5033, MSE 5043 and MSE 5693.

The Doctor of Philosophy Degree. The general credit requirement is a minimum of 90 credit hours beyond the BS degree, including at least 36 hours of credit for research and at least 30 hours of class work. Once approved, it is expected that the courses must include MSE 5013, MSE 5033, MSE 5043 and MSE 5693. Each student is responsible for consultation with his or her advisory committee in preparing the study plan.

Mechanical and Aerospace Engineering

Daniel E. Fisher, PhD— Albert H. Nelson, Jr. Endowed Chair in Engineering, Professor and Head

No other profession unleashes the spirit of innovation like Mechanical Engineering and Aerospace Engineering. From research to real-world applications, mechanical and aerospace engineers discover how to improve lives by creating bold new solutions that connect science to life in unexpected, forward thinking ways. Few have such a direct and positive effect on everyday lives and we count on mechanical and aerospace engineers, and their imaginations, to help us meet the needs of the 21st century.

Mechanical and aerospace engineers know that life takes engineering, and that their disciplines provide freedom to explore, shape the future, encompass an enterprising spirit, and call for limitless imagination. Engineering makes a world of difference and is essential to our health, happiness, and safety. Creative problem solving, while turning dreams into reality, is the core of Mechanical and Aerospace Engineering. These professional disciplines 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 spans an exceptionally wide range of systems, devices and vehicles. Mechanical engineers are vitally concerned with all forms of energy production, utilization and conservation. They are the key professionals in bringing about the green revolution, finding ways to reduce or eliminate pollution, minimize waste, reduce energy usage, and re-use waste, scrap, and recycled goods. They deal with everything mechanical and energy-consuming, whether small or large, simple or complex—from 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, heating and air-conditioning systems to off-shore drilling platforms, and powered home and garden appliances to vehicles of all types. In virtually every organization where engineers are employed, mechanical engineers will be found.

The BS 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 (ABET) 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 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 BS degree program in aerospace engineering is accredited by the Engineering Accreditation Commission of the ABET under the criteria for aerospace and similarly named engineering programs.

MAE Mission: The mission of the School of Mechanical and Aerospace Engineering is to create a vibrant and stimulating learning and research environment and to instruct and encourage our students to reach their full potential in technical expertise, innovative expression, intellectual curiosity, and collaborative design.

MAE Mission for Undergraduate Instruction: The School of Mechanical and Aerospace Engineering will support the MAE and CEAT missions and the mission for instruction of Oklahoma State University by providing a first class education to students that is grounded in engineering fundamentals. The Faculty of MAE are committed to preparing engineers who are:

- Competitive nation-wide and internationally for employment opportunities and who will become respected achievers within their discipline.
- Well prepared for the pursuit of advanced studies at any university.
- Prepared for a lifetime of continuing development, which is demanded by disciplines involved with rapidly progressing technology.

Program Educational Objectives: OSU BSME and BSAE graduates will:

1. Be able to apply their knowledge of engineering to solve complex problems using fundamental principles in combination with modern engineering tools and methods.
2. Be able to use engineering principles to conceptualize, create, model, test, and evaluate designs within a context of local and global needs.
3. Be able to productively function as members of multidisciplinary teams and communicate effectively.
4. Be lifelong learners who understand evolving technical, business and societal issues as well as their ethical responsibilities that impact their engineering profession and the welfare of others.

Student Outcomes and Specific Program Criteria. The student outcomes for students graduating from the mechanical and aerospace engineering BS programs are: (a) an ability to apply knowledge of mathematics, science, and engineering; (b) an ability to design and conduct experiments, as well as to analyze and interpret data; (c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability; (d) an ability to function on multidisciplinary teams; (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) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; (i) a recognition of the need for, and an ability to engage in, life-long learning; (j) a knowledge of contemporary issues; (k) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice. ABET requires specific program criteria which must be supported by the curricula and are unique to engineering disciplines. For the BSME Program, the specific ME program criteria are broken into three elements. The ME curriculum prepares graduates to: ME1- demonstrate an ability to apply principles of engineering, basic science and mathematics (including multivariate calculus and differential equations); ME2- demonstrate an ability to model, analyze, design, and realize physical systems, components or processes; and ME3 – be prepared to work professionally in either thermal or mechanical systems areas while taking courses in each area. For the BSAE Program, the specific AE program criteria are also broken into three elements. The AE curriculum prepares graduates with: AE1 – knowledge of the following aeronautical topics: aerodynamics, aerospace materials, structures, propulsion, flight mechanics, and stability and control; AE2 – knowledge of some of the following astronautical topics: orbital mechanics, space environment, attitude determination and control, telecommunications, space structures, and rocket propulsion; and AE3 – graduates must have design competence which includes integration of aeronautical or astronautical topics.

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. In this selection, no one area may be unduly emphasized at the expense of another. For the aerospace engineering,

biomedical engineering, and premedical programs, prescribed course work provides students with more focused development. Graduates are fully competent as mechanical or aerospace engineers, with abilities in design, and in-depth knowledge in their areas of concentration.

As a fundamental component of all BS programs, engineering design is strongly emphasized in the junior and senior years but is integrated throughout the curriculum. Most MAE courses at the 3000 and 4000 levels include 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 experimental results to 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. The program also 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' experience 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 (MBA). 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. Some design courses involve students in the solution of authentic, current and significant engineering problems provided by industrial firms. 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 degree of Master of Science in Mechanical and Aerospace Engineering, and the degree of Doctor of Philosophy in Mechanical and Aerospace Engineering. Both of these degrees offer an option in Unmanned Aerial Systems and 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: aerodynamics, aeroelasticity, biomedical engineering, design, computational mechanics, heat transfer dynamic systems and controls, fluid mechanics, materials, manufacturing processes, refrigeration, solid mechanics thermal and HVAC systems, unmanned aerial systems, and web handling 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 MS or PhD degree. Graduation from a mechanical or aerospace engineering curriculum accredited by the ABET, with scholastic performance distinctly above average, qualifies the student for admission to the School of Mechanical and Aerospace Engineering as a candidate for the MS and PhD 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 or aerospace 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 credit hours of approved graduate-level course work, and a suitable research thesis of six credit hours. The non-thesis option requires 35 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 60 credit hours beyond the master's degree, including a dissertation for which no more than 30 credit hours may be awarded.

School of Architecture

Randy Seitsinger, MArch, FAIA—Professor and Head

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 program moved into a brand new facility, the Donald W. Reynolds School of Architecture Building in 2009, and at the same time celebrated its centennial as a School of Architecture.

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 and a minor in Architectural History/Theory.

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 mission of the School of Architecture is to prepare future architects and architectural engineers to make vital contributions to humanity through the creation of architecture. The vision of the school is to be nationally recognized for outstanding professionally focused programs in architecture and architectural engineering with strengths in design and the collaboration between architecture and architectural engineering.

The School of Architecture endeavors to instill in each individual 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 only 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, BArch, is accredited by the NAAB. The Bachelor of Architectural Engineering degree, BArchE, is accredited by the Accreditation Board for Engineering and Technology (ABET http://www.abet.org) as an engineering program. Both programs require a minimum of five years of study to complete. In the United States, most state 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 and recognizes three

types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a six-year, three-year, or two-year term of accreditation, depending on the extent of its conformance with established educational standards.

Doctor of Architecture and Master of Architecture degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

The OSU School of Architecture offers an accredited, five-year, Bachelor of Architecture degree.

Bachelor of Architecture – 154 semester credit hours.

The next accreditation visit will occur in 2017.

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.

In the pre-professional portion of the architectural program (approximately two years of study), the focus is on the fundamental principles of design and technology supplemented by appropriate general education courses in English, social sciences and humanities. These courses allow students to assimilate a beginning knowledge base in architecture 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 architecture.

The professional program in architecture (typically three years) builds systematically upon the knowledge acquired in the pre-professional curriculum. Students expand their design and problem-solving abilities through a sequential series of design studios informed by sequences of courses dealing with structure, systems and materials, building technology, the history and theory of architecture, and business and project management principles. In addition students fully utilize the computer as a design and communication tool in the problem-solving process.

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 addition to a student's design studio education, he or she is required to complete sequential courses in structures, 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.

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 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 pre-professional 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 pre-professional 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. 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' experience in solving ever-more-challenging problems gives them the ability to continue to learn independently throughout their professional careers.

Architectural Engineering Educational Objectives. The educational objectives expected of program graduates a few years after graduation are as follows. These graduates:

- Will utilize their education in architectural engineering to contribute to society as licensed professional engineers.
- Will excel in their careers, displaying leadership, initiative, and broad-based knowledge and skills.
- Will have displayed a sensitivity to human needs and other less technical concerns related to the building environment.
- Will have utilized the close relationship with the architecture program to develop a special ability to collaborate with and relate to architects.
- Will have a positive attitude for life-long learning.

The architectural engineering program has adopted the following program outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering.

(b) an ability to design and conduct experiments, as well as to analyze and interpret data.

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

(d) an ability to function on multidisciplinary teams.

(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) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

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

(j) a knowledge of contemporary issues.

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

The program outcomes were adopted with the concept that they would provide students with the educational experience necessary to successfully achieve the longer term program educational objectives.

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 (professional program). 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 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 3.2 "Changes in Degree Requirements" in the "University Academic Regulations" section of the Catalog.) These requirements assure compliance with institutional and accreditation criteria.

Study Abroad. 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 European Study Program based in Rome, Italy. 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 European Study 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.

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 diversity of the faculty is a strength.

The school moved into a new facility in 2009, the Donald W. Reynolds School of Architecture Building, which includes spacious design studios, a greatly expanded architectural library, day lighting lab, computer lab, classroom facilities and many other amenities. The Donald W. Reynolds School of Architecture received an AIA Oklahoma Honor Award recognizing its outstanding design in 2011.

Computers. All School of Architecture students enrolled in either the architecture or architectural engineering programs will be required to purchase a laptop computer as they enter the Professional Program (third year of the curriculum). Updated specifications for the computer and software will be provided each year.

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 16 to one. Annual student enrollment is approximately 350 students.

Academic Advising. The College's Office of Student Academic Services provides initial advisement for all pre-professional architecture students. Prior to application to the Professional School, advisement is provided by the School of Architecture.

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.

Admission to Professional School. Students applying for admission to the Professional School must first meet the required criteria established for each program. Applicants will be selected based upon their performance in the First and Second Year Architecture and Architectural Engineering curricula. Particular courses in the curricula, which have proven to be good indicators of success in the two programs, will be factored with a multiplier to increase their influence in the selection procedure. To be considered for either program, applicants must:

1. Complete a minimum of 55 credit hours of coursework (applicable to the degree plan) prior to admission to professional school.
2. Complete the following required first and second year courses with a grade of 'C' or better:

   For the Architecture program: ARCH 1112, ARCH 2003, ARCH 1216, ARCH 2116, ARCH 2216, ARCH 2263, MATH 2144, PHYS 2014, ENSC 2113, and ENGL 1113.

   For the Architectural Engineering program: ARCH 1112, ARCH 1216, ARCH 2116, ARCH 2216, ARCH 2263, MATH 2144, PHYS 2014, ENSC 2113, ENSC 2143, and ENGL 1113.
3. Achieve a grade of "C" or better in all required ARCH prefix courses, substitutes for ARCH prefix courses, and prerequisites for ARCH prefix courses.
4. Achieve a minimum Selection Grade Point Average (SGPA) of 2.80.

The Selection Grade Point Average (SGPA) will be calculated for each applicant by multiplying course credit hours by the multiplier, multiplying by the numerical course grade and dividing by the total factored hours.

For consideration of admission to the Architecture program, the following courses and multipliers will be used in calculating SGPAs: ARCH 1112 (x1 multiplier), ARCH 2003 (x1 multiplier), ARCH 1216 (x2 multiplier), ARCH 2116 (x2 multiplier), ARCH 2216 (x3 multiplier) ARCH 2263 (x1 multiplier), MATH 2144 (x1 multiplier), PHYS 2014 (x1 multiplier), ENSC 2113 (x1 multiplier), ENGL 1113 (x1 multiplier).

For the Architectural Engineering program the following courses are used in the SGPA calculation: ARCH 1112 (x1 multiplier), ARCH 1216 (x1 multiplier), ARCH 2216 (x2 multiplier), ARCH 2263 (x1 multiplier), MATH 2144 (x2 multiplier), PHYS 2014 (x2 multiplier), ENSC 2113 (x3 multiplier), ENSC 2143 (x2 multiplier), ENGL 1113 (x1 multiplier).

Double Degree. Applicants wishing to enter into the Professional School in both the B.ARCH and B.ARCH ENG. degree programs must apply for both programs and be accepted to each, independent of the other.

Change of Program. Changing programs, Architecture to Architectural Engineering or vice versa, typically occurs via formal application and admission to the other program through the Professional School application and admission process.

Taking ARCH Prefix Courses When Not Admitted to Professional School. Students not admitted to the Professional Schools may not enroll in any 3000 level or higher ARCH prefix course or ARCH 2203 without prior permission of the instructor and Academic Advisor.

Transfer Students. Students wishing to transfer into the Professional School of the OSU School of Architecture must apply for admission to the Professional School in the same manner as OSU students.

Completion of Required Pre-Professional School Courses. All students applying for admission to Professional School must satisfactorily complete all required courses for consideration by the end of the spring semester of the year of application.

Application and Notification Dates. Application for admission, readmission or transfer to the Professional School of Architecture and Architectural Engineering must be made by the last working day of April of the year of intended admission. Notification of selection decisions will normally be made soon after June 1st but not before a two week period after Grade Reports have been received by the School – if there should be ANY problem with a grade that may impact acceptance to the Professional Schools the student should contact the School immediately. Selected applicants must confirm acceptance of the offer of a position in the Professional School by the date indicated in the letter of offer.

Reapplication. Applicants not admitted may reapply for admission to the Professional School the following year; such applicants do not carry any priority or disadvantage but are included in the full application pool.

Division of Engineering Technology

Gouranga Banik, PhD, PE, F. ASCE- Professor and Head

Engineering technology education is concerned with the practical application of engineering achievement with emphasis on 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.

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.

Bachelor of Science in Engineering Technology Degree Programs

Construction Management Technology, 124 hours

Electrical Engineering Technology, 130 hours

Fire Protection and Safety Engineering Technology, 125 hours

Mechanical Engineering Technology, 121 hours

Accreditation. Each Engineering Technology program is accredited by the Engineering Technology Accreditation Commission of ABET, **http://www.abet.org**.

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

Heather Yates, EdD, AC—Associate Professor and Program Director

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

The primary goal of the Department of Construction Management Technology (CMT) 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.

Program Educational Objectives. OSU Construction Management Technology graduates a few years after graduation will:

1. Solve problems typically found in the construction industry in construction engineering design, estimating, planning, scheduling and project management using mathematical, analytical, and scientific skills of engineering technology.
2. Successfully work in teams and communicate effectively in written, oral and graphical forms.
3. Continue life-long career and professional growth by actively interacting with local industries and participating in appropriate professional societies.
4. Continue life-long personal growth in sensitivity to ethical responsibilities, global environments, and associated social issues.

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 Construction Management Advisory Board, representing a broad cross-section of the industry, meets regularly to offer support and guidance necessary to preserve uncompromising excellence.

The Construction Management Technology program is accredited by the Engineering Technology Accreditation Commission of ABET, **http://www.abet.org**. The educational objectives of the Department of Construction Management Technology are consistent with those required by ETAC of ABET and are listed under "Division of Engineering Technology" in the *Catalog*.

Undergraduate Admission. Students who satisfy the University admission requirements are eligible to enroll for the first two years of the program in the lower division of the curriculum for construction management technology. In order to balance the number of students in the CMT upper division with available CMT resources, advancement to the CMT upper division is by application. Applications are due to the CMT Department no later than the last working day of April each year. To be eligible for program advancement, lower division students must have:

1. Completed 60 credit hours of course work counting toward the CMT degree.
2. Completed all of the required (shaded) courses on the Degree Requirement Sheet (these courses are also listed on the Calculation Work Sheet of the Application to Upper Division form).
3. Achieved a grade of 'C' or better in the following courses: CMT 1214, 2253, 2263, ACCT 2103, PHYS 1214, GENT 2323, MATH 2123, and CMT 2343. A substitution for any of these courses must meet the same 'C' requirement.
4. Achieved a minimum Selection GPA (SGPA) of 3.05.

Annually, students who meet these criteria for program advancement and have made a timely application for admission to the upper division will be admitted to the upper division of the CMT curriculum. The Selection Grade Point Average (SGPA) is a weighted GPA based upon specified lower division courses which have proven to be good indicators of student success in the program. For consideration of admission to the upper division of the Construction Management Technology program, the following courses and multipliers will be used in calculating SPGA's: CMT 2343 (x3 multiplier), CMT 2263 (x3 multiplier), GENT 2323 (x3 multiplier), CMT 2253 (x2 multiplier), CMT 1214 (x2 multiplier), MATH 2123 (x2 multiplier), PHYS 1114 (x2 multiplier), SPCH 2713 (x2 multiplier), ENGL 1113 (x2 multiplier), PHYS 1214 (x1 multiplier), MATH 2133 (x1 multiplier), EET 1003 (x1 multiplier) and ACCT 2103 (x1 multiplier). Additional detailed information concerning admission to the upper division may be obtained directly from the CMT department.

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

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 management technology. 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 the construction management technology curriculum, which provides them with 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 the construction management technology curriculum, which provides them with 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 technology 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.

Graduates of construction management technology 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

Imad Abouzahr, PhD, PE—Associate Professor and Interim Head

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

The work of an 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 or field representatives.

The program offers the Bachelor of Science in Engineering Technology degree with a major in Electrical Engineering Technology. An option in computers is also available. To meet diverse needs, the program is laboratory-oriented and provides a strong foundation of specialized mathematics and science courses in applied electrical engineering and related technical areas, as well as courses in the area of communications, humanities, and the social sciences.

Program Educational Objectives. OSU Electrical Engineering Technology graduates a few years after graduation will:

- Be employed in a technical or management position where the skills and knowledge of applied electrical engineering are utilized.
- Continue life-long learning and professional growth through participation and membership in professional organizations and/or through the continuation of professional studies.
- Work proactively and productively in teams and communicate effectively in written, oral and graphical forms.
- Successfully apply mathematical, analytical and technical expertise to industrial problems

The electrical engineering technology graduates can expect to obtain these objectives because at the time of graduation they will have:

(a) an ability to apply knowledge of mathematics, science and engineering;

(b) an ability to design and conduct experiments, as well as to analyze and interpret data;

(c) an ability to design a system, component, or process to meet needs;

(d) an ability to function on multi-disciplinary teams;

(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) the broad education necessary to understand the impact of engineering solutions in a global/societal context;

(i) a recognition of the need for and the ability to engage in life-long learning;

(j) a knowledge of contemporary issues;

(k) an ability to use techniques, skills, and modern engineering tools necessary for engineering practice;

(l) an ability to analyze, design, and implement control systems, instrumentation systems, communications systems, computer systems, or power systems;

(m) an ability to apply project management techniques to electrical/electronic(s) systems;

(n) an ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of electrical/electronic(s) systems;

(o) an ability to make the application of circuit analysis and design, computer programming, associated software, analog and digital electronics, and microcomputers to the building, testing, operation, and maintenance of electrical/electronic(s) systems;

(p) an ability to make the applications of physics or chemistry to electrical/electronic(s) circuits in a rigorous mathematical environment at or above the level of algebra and trigonometry;

(q) an ability to make the ability to analyze, design, and implement control systems, instrumentation systems, communications systems, computer systems, or power systems;

(r) an ability to apply project management techniques to electrical/electronic(s) systems; and

(s) an ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of electrical/electronic(s) systems.

The Electrical Engineering Technology major provides graduates the ability to enter the many dynamic fields of the electrical engineering world. The demand for graduates having electronic and electrical engineering design and application skills remains important and relevant. Graduates of this program will be prepared for a wide range of opportunities for employment in an industry that requires considerable knowledge of the electrical engineering profession.

The Electrical Engineering Technology–Computer option curriculum provides the preparation for graduates to enter the growing field of computer hardware and software engineering. 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 these opportunities in industry that require considerable knowledge of both computer hardware and software engineering skills.

The Electrical Engineering Technology program is accredited by the Engineering Technology Accreditation Commission of the ABET, **http://www.abet.org**.

Fire Protection and Safety Engineering Technology

Qingsheng Wang, PhD, PE, CSP—Associate Professor and Program Director

The fire protection and safety engineering technology (FPST) curriculum provides preparation for assessing and reducing the loss potential with respect to fire, safety, industrial hygiene, and hazardous material incidents. 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 began at Oklahoma State University in 1937 - which is the oldest fire related program in North America. The demand by business and industry for loss control specialists has resulted in the evolution of the program into one that now places emphasis on fire protection, safety, and occupational/environmental health. The FPST program prepares graduates for careers in loss control. The loss control profession is segmented into three major areas: loss from fire, loss from physical accidents, and loss from environmental exposure.

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 program concludes with the Bachelor of Science in Engineering Technology degree in Fire Protection and Safety Engineering Technology.

Program Educational Objectives. OSU Fire Protection and Safety graduates a few years after graduation will be:

1. Earning and pursuing personal, technical and professional advancement through their employment.
2. Continuing the pursuit of life-long learning through membership and participation in professional organizations.
3. Developing business expertise within their selected employment organization.
4. Successfully applying mathematical, analytical, and technical skills to solve complex problems in the selected field.
5. Meeting the highest standards of ethical practice in their profession.

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 engineering technology program.

The Fire Protection and Safety Engineering Technology program is accredited by the Engineering Technology Accreditation Commission of ABET, **http://www.abet.org.**

Mechanical Engineering Technology

Richard A. Beier, PhD, PE—Professor and Program Director

Mechanical engineering technology (MET) is the component of engineering that specializes in design and application. MET 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 knowledge and skills learned during their course of study. Laboratories are equipped 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.

Program Educational Objectives. OSU Mechanical Engineering Technology graduates a few years after graduation will:

1. Be employed in a technical or management position where the skills and knowledge of mechanical engineering technology are utilized.
2. Successfully apply mathematical, analytical, and technical skills to industrial problems, which may include the areas of design, manufacturing, graphical communications, and fluid power.
3. Within your employment environment, work proactively and productively as both members and leaders of teams.
4. Within your employment organization, communicate effectively in written, oral and graphical form.
5. Continue life-long learning by bringing new technology into their workplace, through participation and membership in professional organizations and/or through the continuation of professional studies.

Preparation for a specific industrial function is 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.

The Mechanical Engineering Technology program is accredited by the Engineering Technology Accreditation Commission of ABET, **http://www.abet.org**.