College of Engineering

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Mission Statement

The mission of the College of Engineering is to achieve prominence as a student-focused college that educates engineers of recognized quality to be leaders in engineering disciplines, technology and society; and as a college that enhances the well-being of the region, state and nation through the creation and transfer of new knowledge.

Accreditation

The College of Engineering's bachelor of science programs in bioengineering, chemical engineering, civil engineering, computer science and engineering, electrical engineering and mechanical engineering are accredited by the Engineering Accreditation Commission (EAC) of ABET, www.abet.org. The program in computer science and engineering is also accredited by the Computing Accreditation Commission (CAC) of ABET.

The bachelor of science programs in computer science and engineering technology, construction engineering technology, mechanical engineering technology and electrical engineering technology are accredited by the Technology Accreditation Commission (TAC) of ABET, www.abet.org. The program in computer science and engineering technology is also accredited by the Computing Accreditation Commission (CAC) of ABET.

Programs of Study

Undergraduate Degree Programs

The College of Engineering offers six bachelor of science in engineering programs – bioengineering, chemical engineering, civil engineering, computer science and engineering, electrical engineering and mechanical engineering. The college also offers four bachelor of science in engineering technology programs - computer science and engineering technology, construction engineering technology, electrical engineering technology and mechanical engineering technology - and a bachelor of science program in information technology. A minor in computer science and engineering is also available. Details are found in the Undergraduate Degree Programs of Study section of this catalog.

Students may wish to consider a dual degree plan within the College of Engineering. Depending on which two curricula are involved, careful planning from the beginning may permit the completion of

both degrees with less than a full year of additional study. In any dual degree plan, the student must be accepted by both major departments and have an adviser from each of the two degree programs. With any combination, the curricular requirements of each individual degree must be met.

Graduate Programs

The College of Engineering also offers a full range of graduate programs. Refer to the Graduate School section for information on programs and policies specifically related to graduate students.

Cooperative (Co-op) Education Program

Students in the engineering programs must complete a cooperative (co-op) educational requirement. The purpose of the co-op program is to provide students with career-related experiences. The program also helps students defray the cost of their education and enhances employment opportunities after graduation. The curriculum in each of the engineering programs is set up to accommodate four, and in some cases five, co-op assignments. To satisfy the requirement, a student must successfully participate in at least three semester-long work experiences, alternating with semesters of coursework, but many participate in four or more. The student pays a $475 fee for each of the first three registered co-op experiences. Successful completion of each registered work experience appears on the student's transcript. A student with a registered work experience is considered a full time student for that term. The college will assist students in finding co-op positions, but does not guarantee placement. Elaborations on implementation policies are available in the college's Career Management Center.

For students in the engineering technology degree programs, participation in the co-op program is optional. Students who wish to participate in this program should contact the Career Development Center in the College of Engineering at 419.530.8050.

Admission Requirements

First Time Freshmen

To be considered for admission to any bachelor of science program in engineering, first time freshman students need a minimum cumulative high school GPA of 3.0 (or GED average standard score of 510) **and** a minimum ACT composite score of 22 (or SAT combined score of 1030). Those taking the ACT or SAT must submit a writing section score. Students also must successfully complete a minimum of four years of high school mathematics (with coverage of trigonometry or precalculus) and high school chemistry (physics also is strongly recommended). Students who do not meet the minimum requirements will be considered for admission to an engineering technology program or they may choose another University program.

To be considered for admission to one of the bachelor of science in engineering technology programs or information technology program, first time freshman students need a minimum cumulative high school GPA of 2.4 (or GED average standard score of 480) **and** a minimum ACT composite score of 21 (or SAT combined score of 990). Those taking the ACT or SAT must submit a writing section score. Students who do not meet the minimum requirements will be considered for admission to the UT Learning Collaborative Gateway Programs or may choose another University program.

Transfer Students

Transfer students seeking admission to the bachelor of science programs in bioengineering, chemical engineering, civil engineering, computer science and engineering, electrical engineering or mechanical engineering must have a minimum GPA of 2.75 from all previous college or university work and have college credit for MATH 1850 Calculus I and CHEM 1230 General Chemistry, or equivalents, with grades of at least a C. Students who have attended more than one university will be evaluated on a case-by-case basis.

Students transferring into the College of Engineering bachelor of science in engineering technology programs in construction engineering technology, electrical engineering technology, mechanical engineering technology and computer science and engineering technology from other colleges within the University or from other universities must have obtained a minimum cumulative GPA of 2.0. A minimum cumulative GPA of 2.25 is required to transfer into the College of Engineering bachelor of science program in information technology. Students not admitted to an engineering program may not take engineering courses unless those courses are required for a degree program outside of engineering.

Students transferring from other institutions must earn at least 32 hours of undergraduate credit in residence at The University of Toledo. At least 14 of these must be in the major area. The remaining credit hours are to be in engineering topics or in other areas that satisfy degree requirements.

Full-time students must take their last semester in residence (part-time students must take their last 14 hours in residence) unless exceptional arrangements have been made in advance with the associate dean of undergraduate studies in the college.

A total of 128 hours of course credit is required for the bachelor of science degrees, not including co-op hours. Normally, 64 hours of the baccalaureate programs in engineering technology may be transferred from an accredited community or technical college. Additional transfer credits may be applied over the 64-semester hour limit at the discretion of the undergraduate program director.

Honors Program

The Honors Program in the College of Engineering provides opportunities for challenging and individual study to undergraduate students of unusually high ability, motivation and initiative.

Students with a minimum high school GPA of 3.5 and a minimum ACT composite of 25 are encouraged to apply. Current University of Toledo students and transfer students may apply for admission to the Honors Program if they have completed at least 15, but not more than 60, graded semester hours with a minimum UT GPA of at 3.5, and have been interviewed by an honors adviser. All admissions to the Honors Program are granted on a space-available basis.

To receive the College Honors citation upon graduation from an engineering bachelor's degree program, the following criteria must be met:

1. A minimum higher education GPA of 3.3.

2. A total of 33 semester hours in honors courses, six of which must be in the interdisciplinary honors area (Readings Conference) and 10 of which must be in honors courses offered by the UT College of Engineering.

3. An honors thesis or honors project.

Academic Policies

Students in the College of Engineering are subject to the general regulations that apply to all students enrolled in The University of Toledo. Refer to the *UT Policy website* for academic policies that apply to all students. In addition, certain regulations apply only to those who are enrolled in the College of Engineering. These are described below.

General Degree Requirements

To obtain a degree in an undergraduate program, students must have the proper number of credit hours in courses required for the curriculum, a minimum overall cumulative GPA of 2.0 (average of C), and a minimum GPA of 2.0 in the student's major. When a course is repeated (see below), only the grade the last time a course was taken is used in the calculation of the major GPA.

Curricular Requirements

All six of the 128-hour bachelor of science programs in engineering have a common structure of mathematics, basic sciences, humanities/fine arts, social sciences, multicultural studies and engineering topics, plus three required semesters of co-operative education. The five 128-hour bachelor's programs in engineering technology and information technology have curricula that lead to bachelor of science degrees, for which co-operative education is optional.

The required curriculum and recommended course sequence for each program is presented in the

website of the department offering that program. These curricula permit the student to complete the engineering degree requirements, along with the co-op requirement, in five years; and the engineering technology and information technology degree requirements, without co-op, in four years.

University Core Curriculum

All degree candidates are required to complete between 27 and 30 credit hours of courses that comprise the University General Education/Core Curriculum. The courses are distributed in the areas of English composition, humanities/fine arts, social sciences, natural sciences, mathematics and multi-cultural studies. Completing the University General Education/Core Curriculum will satisfy the humanities/fine arts/social sciences/multicultural requirement in the College of Engineering.

Pass/No Credit Option

Engineering students have the option to take a maximum of two humanities/fine arts/social science/multicultural courses on a pass/no credit basis. Pass/no credit grade forms are available in the Engineering Undergraduate Office (Nitschke Hall Room 1045). The form must be returned to the Registrar's Office before the end of the 15th calendar day of the term.

Repeated Courses/GPA Recalculation

Students may repeat a previously attempted course. If the grade in the repeated course is higher, the student may petition the college in which the course is taught to have the initial grade excluded from the overall GPA calculation. Complete information about the GPA Recalculation Policy may be found in the *UT Policy website*. Note that all grades, including those for repeated courses, will be included in the determination of eligibility for graduation honors, fellowships, or other distinctions awarded on the basis of GPA. However, when a course in the major is repeated, only the grade the last time the course is taken is used in the major GPA calculation.

Required Academic Performance

All students are expected to maintain a minimum cumulative GPA of 2.0. A student who achieves less than a 2.0 GPA the first semester will be placed on probation and is expected to make marked advancement in subsequent semesters in order to achieve an overall 2.0 GPA. Anything less will lead to suspension or dismissal according to the policy outlined in the next section.

After 100 hours have been attempted, students should request a degree audit from their undergraduate director to formulate plans for completion of the program and obtain the necessary approval of the associate dean of undergraduate studies. Preparation of the final two-semester schedule should be completed to assure that the degree requirements will be met. Application for graduation should be made to the Registrar's Office before the published deadline, in accordance with the procedures

noted in the General Section of this catalog.

Probation, Suspension, Readmission and Dismissal

After each semester, each student's progress is reviewed. Students who do not meet the minimum academic achievement level will be placed on probation or, if already on probation, may be suspended or dismissed from the college according to the rules below:

Probation

1. A student whose cumulative GPA is less than 2.0 will be placed on probation. In successive semesters, a student may remain in school as long as he/she continues to earn a GPA greater than 2.0 in each term. However, the student will remain on probation as long as the cumulative GPA is below 2.0. A student is removed from probation when the cumulative GPA is above 2.0.

2. A student earning a 1.5 GPA or less in any semester, regardless of the overall GPA, will be placed on probation.

3. Students on probation will not be permitted to interview for co-op positions.

Suspension

1. A student on probation whose cumulative and current semester GPA is below 2.0 will be subject to suspension from the college for one semester.

2. Consideration of a student's petition for reinstatement will be given only after one semester from the date of suspension. In some circumstances, the suspension may be deferred.

Readmission

1. Readmission will only be by written petition to the college's associate dean of undergraduate studies. Readmission decisions will be made by the associate dean of undergraduate studies in conjunction with the department to which the student is requesting readmission.

2. The petition must be neatly written and must be received at least one month prior to the start of the semester the student desires to return.

Dismissal

1. If readmission is granted after a suspension, the student will be subject to dismissal from the college unless he/she earns a semester GPA greater than 2.0 each term until the cumulative GPA is above 2.0.

2. Further consideration of a student's petition for reinstatement will be given only after one year from the date of dismissal.

Professional Registration

Registration by the State of Ohio as a Professional Engineer is important for professional practice and requires four to eight years of engineering experience after graduation. However, the first step is applying for and passing the Fundamentals of Engineering (FE) examination, formerly known as the Engineer-in-Training (EIT) exam. The exam is generally given in April and October of each year. Application deadlines, however, are several months earlier. All engineering graduates are strongly encouraged to take the FE near their date of graduation and are permitted to sit for the exam up to six months prior to graduation with a letter from the dean. After four years of acceptable engineering experience, the State Board of Registration will permit the engineering graduate to take the Professional Engineers (PE) examination. Engineering technology graduates must pass the FE exam and need a minimum of eight years of engineering experience before taking the PE exam.

For students graduating in the spring or summer, the FE Examination is given at several locations around Ohio on a Saturday in April. For fall graduates, the exam is given on a Saturday in October. Applications should be filed with the board in Columbus at least 90 days prior to the examination date. Additional information is available in the Office of Undergraduate Studies, from the Secretary of the Board of Registration for Professional Engineers and Surveyors, 77 S. High St., Columbus, OH 43266-0314, *www.ohiopeps.org*, or from the National Council of Examiners for Engineering and Surveying Web site at *www.ncees.org*.

Undergraduate Degree Programs of Study

The bachelor of science programs in engineering demonstrate that their graduates attain the following 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 bachelor of science programs in engineering technology demonstrate that their graduates have the following learned capabilities:

a. an ability to select and apply the knowledge, techniques, skills, and modern tools of their discipline to broadly defined engineering technology activities

b. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies

c. an ability to conduct standard tests and measurements; to conduct, analyze and interpret experiments; and to apply experimental results to improve processes

d. an ability to design of systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives

e. an ability to function effectively as a member or leader on a technical team

f. an ability to identify, analyze and solve broadly-defined engineering technology problems

g. an ability to apply written, oral, and graphical communication in both technical and nontechnical environments; and an ability to identify and use appropriate technical literature

h. an understanding of the need for and an ability to engage in self-directed continuing professional development

i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity

j. a knowledge of the impact of engineering technology solutions in a societal and global context, and

k. a commitment to quality, timeliness, and continuous improvement

The bachelor of science programs in computer science and engineering, computer science and engineering technology and information technology enable their students to attain, by the time of graduation:

(a) An ability to apply knowledge of computing and mathematics appropriate to the discipline

(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs

(d) An ability to function effectively on teams to accomplish a common goal

(e) An understanding of professional, ethical, legal, security and social issues and responsibilities

(f) An ability to communicate effectively with a range of audiences

(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society

(h) Recognition of the need for and an ability to engage in continuing professional development

(i) An ability to use current techniques, skills, and tools necessary for computing practice.

Minor in Computer Science and Engineering

Students may earn a minor in computer science and engineering (CSE) by completing the six required courses listed below, plus two courses selected from the list of advanced courses. To be eligible to register for these courses, students must be coded as CSE minor candidates and have successfully completed MATH 1850 and MATH 1860. A GPA of 2.0 is required in the EECS courses.

Required courses:

EECS 1100 Digital Logic Design 4
EECS 1560 Introduction to Object Oriented Programming 3
EECS 1570 Linear Data Structures 3
EECS 1580 Nonlinear Data Structures 3
EECS 1590 Discrete Structures 3
EECS 2110 Computer Architecture and Organization 3

Advanced courses (select two):

EECS 2550 Operating Systems and Systems Programming 3
EECS 3100 Microsystems Design 4
EECS 3500 Formal Languages and Automata 3
EECS 3550 Software Engineering 3
EECS 4130 Digital Design 3
EECS 4500 Programming Language Paradigms 3
EECS 4510 Translation Systems 4
EECS 4530 Computer Graphics I 4
EECS 4560 Database Systems I 3

Special Programs for Undergraduates

Minor in Business Administration

Engineering students may earn a minor in business administration by earning a C or better in six business courses, plus at least one economics course. The economics requirement may be satisfied with MIME 2600 or with ECON 1150 and 1200. The six business courses must include BUAD 2040, while the other five may be selected from the list in the College of Business and Innovation section. For students whose goal is to earn an M.B.A., the following six courses are recommended:

BUAD 2040 Financial Accounting Information
BUAD 2050 Accounting for Business Decision Making
BUAD 3010 Principles of Marketing

BUAD 3020 Principles of Manufacturing and Service Systems

BUAD 3030 Managerial and Behavioral Processes in Organizations

BUAD 3040 Principles of Financial Management

Students not interested in an M.B.A. may wish to make substitutions in this list. For example, IBUS 3150, Understanding Cultural Differences for Business, could be used in place of any of the above courses except BUAD 2040, to simultaneously satisfy part of the multicultural requirement in the University Core Curriculum. The flexibility of the requirements allows students to focus in areas such as marketing, sales, finance, management or entrepreneurship.

Students must be sophomores to take the 2000-level business courses and juniors to take the 3000-level courses. Also, BUAD 2040 must be taken before BUAD 3040, and the economics requirement must be satisfied before taking BUAD 3010. Otherwise, business prerequisites are waived for engineering students. Students should register with the College of Business and Innovation to become candidates for the business minor.

Students in the mechanical engineering program may use one of the business courses as a technical elective. Students in the civil or electrical engineering programs may use one of the business courses as a technical elective if they complete the business minor requirements. Students in the chemical or computer science and engineering program may use business courses as free electives. Students in engineering technology programs may use one or more of the business courses as professional development electives.

Students interested in a business minor should consult advisers in the College of Business and Innovation and the College of Engineering.

Early Admission to Master of Science in Engineering

The College of Engineering offers students currently enrolled in a bachelor of science in engineering program at The University of Toledo an opportunity to begin work toward a master of science degree in engineering. This option offers talented students who intend to continue their education beyond the B.S. a unique opportunity to begin their graduate research activities at an earlier stage in their career and proceed into the graduate programs in a timely manner.

Up to nine semester credit hours of graduate-level technical elective or required courses may be applied toward the B.S. degree in lieu of selected undergraduate elective courses, subject to specific departmental restrictions. Only 5000-level or higher engineering courses taken at The University of Toledo may be applied toward this option. In addition, an approved M.S. plan of study must be filed indicating

those courses that will be accepted in lieu of specific B.S. course requirements. Application and admission requirements are described in the graduate section of the catalog.

Normally, the B.S. engineering degree programs (with co-op) require five years and the M.S. engineering degree programs require an additional two years. It is anticipated that by participating in this option, a total of six years will be required for the completion of both degrees.

Joint B.S. in Engineering or Engineering Technology/M.B.A. Program

The College of Business and Innovation, in conjunction with the College of Engineering, offers a program whereby a student may earn a bachelor of science in engineering or engineering technology and a master of business administration (M.B.A.). This program provides a unique opportunity to combine business and engineering skills to prepare graduates for global competitiveness and supports the mission to prepare corporate leaders for the future. The program should be particularly attractive to students who want to start their own company or who simply want to develop an appreciation for how engineering and business complement each other.

This program will allow engineering students in their final two semesters of study to begin taking M.B.A. courses while completing their B.S. Students with senior standing may be formally admitted in-to the M.B.A. program and can complete the M.B.A. at the end of six years of study. The business undergraduate prerequisites can be satisfied as part of the undergraduate curriculum.

To be admitted to the program, students must have senior standing, score a minimum of 450 on the Graduate Management Admissions Test (GMAT) and have at least a 3.0 cumulative GPA. Students also must have completed the requirements for the business minor. The business minor courses should be chosen carefully however, as not all business minor courses can be used towards the M.B.A. The six business courses listed in the business minor section plus MIME 2600 or ECON 1150 and 1200 satisfy the basic core prerequisite requirement for the M.B.A. program for engineering students.

Students who wish to pursue the program should inform the associate dean of undergraduate studies in the College of Engineering during their junior year and complete the GMAT by the end of their junior year. Students should submit completed application materials to the Graduate School for admission to the M.B.A. program the fall semester of their senior year. Upon admission to the program by the Graduate School and the College of Business and Innovation, students will be classified as special provisional graduate students so that they may take graduate courses while completing the bachelor of science degree requirements. Students' special status must be tracked by the M.B.A. office to assure AACSB compliance. Also, the B.S. in engineering or engineering technology must be granted in a semester prior to graduating with the M.B.A.

To satisfy the requirements for the M.B.A., students must complete all of the core and elective required courses in the M.B.A. program. By choosing the correct courses, this may be accomplished with six undergraduate- and 11 graduate-level business courses.

Normally, the B.S. engineering degree programs (with co-op) require five years, and the M.B.A. would require an additional two years. It is anticipated that by enrolling in the two programs simultaneously, a total of six years will be required for completion of both degrees. Similarly, for engineering technology students, the degree program normally requires four years, and the M.B.A. program would require an additional two years. It is anticipated that by enrolling in the two programs simultaneously, a total of five and one half years will be required for completion of both degrees.

Guaranteed Admission Program to the University of Toledo College of Law

Students who graduate with a bachelor of science degree from the College of Engineering, have a minimum GPA of 3.4, an LSAT score at or above the 50th percentile, and who have not committed an act or acts involving moral turpitude (e.g., a felony, an academic suspension) will be guaranteed admission to The University of Toledo College of Law upon submission of a completed application.

College of Engineering Faculty

Department of Bioengineering

Brent D. Cameron, 2000, assistant professor

B.S.B.E., M.S.B.E., Ph.D., Texas A&M University

Ronald L. Fournier, 1985, professor

B.S.Ch.E., M.S.Ch.E., Ph.D., The University of Toledo; P.E. (Ohio)

Vijay K. Goel, 2000, professor & McMaster/Gardner endowed chair

B.E., Panjabi University; M.E., Roorkee University; Ph.D., University of New South Wales

Jian-yu Lu, 1997, professor

B.S.E.E., Fudan University; M.S., Tongji University; Ph.D., Southeast University

Scott C. Molitor, 2000, associate professor and undergraduate program director

B.S.E., University of Michigan; Ph.D., Johns Hopkins University School of Medicine

Arunan Nadarajah, 1996, professor and chair

B.Tech.Ch.E., Indian Institute of Technology; M.S.Ch.E., Ph.D., University of Florida

Patricia A. Relue, 1993, associate professor and graduate program director
B.S.Ch.E., The University of Toledo; M.S.ChE., Ph.D., University of Michigan

Emeritus Faculty
Frank J. Kollarits, 1980, professor emeritus
B.S., M.S., John Carroll University; Ph.D., The Ohio State University

Demetrios D. Raftopoulos, 1967, professor emeritus
B.S.C.E., Widener College; M.S.C.E., University of Delaware; Ph.D., Pennsylvania State University; P.E. (Pennsylvania, Ohio, New Jersey)

Vikram J. Kapoor, 1994, professor & dean emeritus
M.S., Ph.D., Lehigh University

Prestige Faculty
Jeffrey Brown, 2002, adjunct professor
B.S., Trinity College; M.D., University of Chicago

Henry Goitz, 2002, adjunct professor
A.B., Cornell University; M.D., Rutgers University

Department of Chemical and Environmental Engineering
Abdul-Majeed Azad, 2003, professor
B.Sc., Jamshedpur Cooperative College; M.Sc., Ranchi University; Ph.D., University of Madras

Maria R. Coleman, 1998, professor
B.S., Ch. E., Louisiana Tech University; Ph.D., The University of Texas at Austin; PE (Arkansas)

John P. Dismukes, 1996, professor
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Isabel C. Escobar, 2000, professor and interim assistant dean for research development and out-réach
B.S.Env.E., M.S.Env.E., Ph.D., University of Central Florida

Saleh A. Jabarin, 1987, professor and director of the Polymer Institute
B.A., Dartmouth College; M.S., Polytechnic Institute of New York; Ph.D., University of Massachusetts

Dong-Shik Kim, 2000, associate professor and undergraduate program director
B.S.Ch.E., M.S.Ch.E., Seoul National University; Ph.D., University of Michigan

Yakov Lapitsky, 2009, assistant professor
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