

# COLLEGE OF ENGINEERING

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# COLLEGE OF ENGINEERING

## Engineering Programs

### Accreditation

The College of Engineering bachelor of science programs in bioengineering, chemical engineering, civil engineering, computer science and engineering, electrical engineering, industrial engineering and mechanical engineering are accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone 410.347.7700. The program in computer science and engineering is also accredited by the Computing Accreditation Commission (CAC) of ABET.

### Engineering Degree Programs

The College of Engineering offers seven bachelor of science in engineering programs: bioengineering, chemical engineering, civil engineering, computer science and engineering, electrical engineering, industrial engineering and mechanical engineering. The college also offers four bachelor of science degree programs and three associate of applied science degree programs in engineering technology that are described later in the engineering technology programs section.

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 that enhances the well-being of our region, state and nation through the creation and transfer of new knowledge.

Engineering students may wish to consider a dual degree plan within the College of Engineering. Depending on which two engineering 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 in Engineering

Graduate work in engineering is described in the College of Engineering section of the Graduate School section of this catalog.

### Early Admission to M.S. 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 towards 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 9 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 towards 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.

### Minors

#### Minor in Computer Science and Engineering

Students may earn a minor in computer science and engineering (C.S.E.) by completing the five 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 C.S.E. 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 1530	Introduction to Programming .....	3
EECS 1540	Discrete and Linear Structures .....	4
EECS 1550	Nonlinear Data Structures .....	4
EECS 2100	Computer Organization and Assembly Language .....	4

##### Advanced courses:

EECS 2550	Operating Systems and Systems Programming .....	3
EECS 3100	Microsystems Design .....	4
EECS 3500	Automata and Language Translation Systems .....	4
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
EECS 4580	Survey of Artificial Intelligence .....	4
EECS 4980	Special Topics: Java .....	3

#### 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 both 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 Administration 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 to become candidates for the business minor.

Students in the civil, industrial or mechanical engineering programs may use one of the business courses as a technical elective. Students in the electrical engineering program 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 interested in a business minor should consult advisers in both the College of Business Administration and the College of Engineering.

## Programs with Other University of Toledo Colleges

### Joint B.S. in Engineering/M.B.A. Program

The College of Business Administration, in conjunction with the College of Engineering, offers a program whereby a student may simultaneously earn both a bachelor of science in engineering 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. It supports the mission to prepare corporate leaders for the future and to our knowledge is a one of a kind program in the state of Ohio. The program should be particularly attractive to students who might 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 into 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 grade point average (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.

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 **before** fall semester of their senior year. Upon admission to the program by the Graduate School and the College of Business Administration, 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 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 right courses, this may be accomplished with six undergraduate and 10 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.

## 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 with at least a 3.4 GPA and an LSAT score at or above the 50<sup>th</sup> 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.

## Admission Requirements

### Entering Freshmen

To be considered for admission to any bachelor of science program in engineering, students need at least a 3.0 cumulative high school GPA **and** a minimum ACT composite score of 22 (or SAT combined score of 1010). Applicants to the computer science and engineering program are required to have a 3.0 high school GPA and a 25 ACT (SAT of 1120) **or** a 3.2 high school GPA and a 22 ACT 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 is also strongly recommended). Students who do not meet the minimum requirements will be considered for admission to engineering technology 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, industrial engineering and mechanical engineering must have obtained a minimum cumulative GPA of 2.75 from their previous college or university, and have college credit for Calculus I and General Chemistry. 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 at least 2.0. 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 remainder are to be in engineering topics or other hours 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. Bachelor of science in engineering technology students must earn at least 30 hours at The University of Toledo, not including deficiencies. Associate of applied science students must earn at least 17 hours at The University of Toledo; at least 8 hours must be in the major.

## Cooperative (Co-op) Education Program

Students in the engineering programs are required to complete a cooperative (co-op) educational requirement. For engineering technology students, participation in the co-op program is optional. 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 upon 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 participate in at least three semester-long work experiences in which work and school alternate, but many participate in four or even five. The student pays a \$400 fee upon completion of each work experience. Successful completion of each work experience appears on the student's transcript. 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.

## 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 high school GPA of 3.5 and an ACT composite of at least 25 are encouraged to apply. Currently enrolled University of Toledo students and transfer students may apply for admission to the College Honors Program if they have completed at least 15, but not more than 60, graded semester hours with a UT GPA of at least 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 Honors Citation upon graduation from an engineering bachelor's degree program, the following criteria must be met:

1. A cumulative GPA of at least 3.3.
2. A total of 33 semester hours in honors courses are required, 6 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 General Academic Policies in the General Section of this catalog. 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 cumulative GPA of at least 2.0 overall (average of C), and at least 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.

## Pass/No Credit Option

Engineering students have the option of electing 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 15<sup>th</sup> calendar day of the term.

## Repeated Courses/Grade Deletion

Students may repeat a course attempted previously in which they received a grade of C-, D+, D, D- or F. If the grade in the repeated course is a C or higher, the student may petition the college in which the course is taught to have the initial grade deleted from the overall GPA calculation. Refer to General Academic Policies in the General Section of this catalog for complete information about the Grade Deletion Policy. Courses in which the student received a grade of C or better may not be repeated either for credit or for the purpose of raising the cumulative GPA or the GPA in the major area. 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.

## Curricular Requirements

All seven 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. Three of the engineering technology programs offer a two-year associate's degree curriculum, while all four have curricula that lead to a four-year bachelor of science degree.

The required curriculum and recommended course sequence for each engineering program is presented in the departmental section of this catalog. These curricula permit the student to complete the degree requirements, along with the co-op requirement, in **five** years.

## University Core Curriculum

All engineering degree candidates are required to complete between 27 and 30 credit hours of courses that comprise the University Core Curriculum. This will satisfy the humanities/fine arts/social sciences/multicultural requirement in the College of Engineering.

*Please refer to the General Section of this catalog for additional information.*

## Mathematics and Basic Science

All bachelor of science programs in engineering require at least 32 hours of mathematics and basic science that include calculus through differential equations, 10 hours of calculus-based physics and at least one semester of general chemistry. Courses required in these subjects include MATH 1850, 1860, 2850 and 3860, PHYS 2130 and 2140 and CHEM 1230. Individual programs may have additional requirements in mathematics, chemistry, biology and/or geology.

## Engineering Topics

Each program requires a minimum of 48 hours of engineering topics. This is designed to give the graduate a sound background in engineering science and a meaningful design experience appropriate to the selected field of study. The desired outcomes vary from one program to another, but it is expected that graduates from all the B.S. programs will have developed

- an ability to apply knowledge of mathematics, science and engineering;
- an ability to design and conduct experiments, as well as to analyze and interpret data;
- an ability to design a system, component or process to meet desired needs;
- an ability to function on multidisciplinary teams;
- an ability to identify, formulate and solve engineering problems;
- 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/societal context;
- a recognition of the need for and an ability to engage in life-long learning;
- a knowledge of contemporary issues; and
- an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

## Required Academic Performance

All students are expected to maintain at least a 2.0 cumulative GPA. 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 a 2.0 overall GPA. Anything less will lead to suspension or dismissal according to the policy outlined below.

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 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 the degree should be made at the Registrar's Office before the published deadline.

## 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 following rules:

### 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 they continue 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 falls 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 typewritten 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, a semester average greater than 2.0 must be earned each term until the cumulative GPA is above 2.0 or the student will be subject to dismissal from the college.
2. Further consideration of a student's petition for reinstatement will be given only after **one year** from the date of dismissal.

## Professional Registration

### Graduates of Engineering Programs

Registration by the State of Ohio as a Professional Engineer is important for professional practice and requires four 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. After the necessary period of acceptable engineering experience, the State Board of Registration will permit the 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 on-campus during a Saturday in April. For fall graduates, the FE exam is given in Columbus on a Saturday in October. Applications should

be filed with the board in Columbus at least 75 days prior to the April examination date and at least 60 days prior to the October examination date. Further information is available in the Office of the Associate Dean of Undergraduate Studies, or from the Secretary of the Board of Registration for Professional Engineers and Surveyors, 77 S. High St., Columbus, OH 43266-0314, or from the National Council of Examiners for Engineering and Surveying Web site at [www.ncees.org](http://www.ncees.org).

## Programs of Study

### Department of Bioengineering

*Vijay K. Goel, chair*

#### Degrees Offered

The department of bioengineering offers an ABET-accredited course of study leading to the bachelor of science degree in bioengineering (B.S.B.E.).

Bioengineering is a relatively new discipline that applies engineering and life science principles to study, understand, modify and control biological systems. Bioengineering is a branch of engineering in which knowledge and skills are applied to define and solve problems in biology and medicine. Bioengineers develop and improve concepts, techniques and solutions that may be applied to a variety of problems in medicine and in the manufacture of bio-related products, instruments and devices. Bioengineers are employed by various industries, including drug companies, the bioprocessing industry, medical device manufacturers, hospitals, research facilities in universities and medical institutes, and in governmental regulatory agencies.

The bioengineering program of study combines a background in biology with training in advanced mathematics, chemistry, physics and traditional engineering topics to meet the following educational objectives:

- Bioengineering graduates will be able to formulate and solve problems at the interface of engineering and the life sciences. Our graduates will have the ability to obtain, analyze and interpret data from living systems; the ability to use modern techniques, skills and tools necessary for bioengineering practice and for disseminating the results of their work; and the ability to function on multidisciplinary teams consisting of engineers, clinicians, medical researchers, biologists and non-technical personnel.
- Graduates of our program will be prepared for positions as practicing engineers in various industries and government agencies that are involved in the development, testing, marketing, and regulation of medical devices, medical systems, diagnostic systems, pharmaceuticals and other therapeutic systems. Our graduates will have the ability to design systems, devices and processes for use in medicine, health care or biological applications; and an understanding of the economics, technical aspects, regulatory environment and societal impact of biomedical research, process development or product development.
- Our graduates will also be prepared for admission into medical schools to pursue careers in clinical medicine, or for continued study at the graduate level to pursue careers in biomedical research, business or law. Our graduates will have the ability to design, conduct and document laboratory experiments involving biological

or medical systems; and an understanding of contemporary issues, professional responsibilities and ethical responsibilities in biology and medicine.

The undergraduate curriculum consists of the following components. The first component is a balanced general education in communication skills, social sciences, humanities/fine arts and an awareness of multicultural issues. The next component is a background in biology, chemistry, mathematics, physics, physiology and computers. A general engineering component provides our students with a foundation in electrical engineering, mechanics, thermodynamics and transport phenomena. Additional coursework in biomechanics, bioprocessing and medical instrumentation apply general engineering principles to biological and medical systems. A series of technical elective courses provide students the opportunity to specialize in orthopedic biomechanics, diagnostic devices and sensors, medical imaging or cellular and molecular biology. Students may also use some of their technical electives (e.g., organic chemistry) to satisfy the entrance requirements for medical schools. The curriculum culminates in a design project that serves to integrate, apply and demonstrate the knowledge gained throughout the program.

More information is available on the department Web site: <http://www.bioe.eng.utoledo.edu>

#### Premed Programs

Bioengineering provides an excellent preparation for students interested in pursuing medical careers. According to data from the American Association of Medical Colleges for the 1999-2000 entering class, bioengineers were accepted into medical school at higher rates and generally score higher on the Medical College Admission Test (MCAT) than students who major in the physical sciences. The department of bioengineering at The University of Toledo offers a premed concentration that allows students to take the courses that will prepare them for the MCAT exam and for medical school. Any student in bioengineering can receive a B.S.B.E. with a premed concentration if they successfully complete the following courses:

CHEM 2410/2460 Organic Chemistry I w/ laboratory  
CHEM 2420/2470 Organic Chemistry II w/ laboratory

Students interested in using bioengineering as a premedicine program should consult with both the premed adviser in the College of Arts and Sciences and their faculty adviser in the department of bioengineering.

#### Accelerated Premed Program

The department of bioengineering at The University of Toledo offers a special program that allows premed students to complete their B.S. in bioengineering in four years with an accelerated curriculum. To qualify for this program, premed students must earn a GPA of at least 3.5 during their first semester and maintain a cumulative GPA of 3.5 through the end of their second year. Interested premed students should contact the academic program coordinator to participate in this program.

#### Joint B.S./M.D. Program with MCO

The department of bioengineering also offers a joint B.S./M.D. program with the Medical College of Ohio (MCO). Following completion of their B.S. in bioengineering, students in this program are guaranteed acceptance into the medical school at MCO provided they:

**Degree Requirements**

Students should follow and complete the degree requirements as displayed in the Bioengineering Program —Plan A, B or C (PreMed Option) charts.

**Bioengineering Program - Plan A**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 Chemistry Lab I 1 cr. ENGL 1110 College Composition I 3 cr. BIOE 1000 Orientation & Intro to BioE 2 cr. <b>Total 14 hours</b>	CHEM 1240 General Chemistry II 4 cr. CHEM 1290 Chemistry Lab II 1 cr. MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Engineering Physics I 5 cr. BIOE 1200 Computer Prog. for Bioengr. 3 cr. <b>Total 17 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calc. 4 cr. PHYS 2140 General Physics II 5 cr. BIOL 2150 Fund of Life Science I 4 cr. BIOL 2160 Fund of Life Science Lab 1 cr. BIOE 2200 Biomaterials 3 cr. <b>Total 17 hours</b>	MATH 3860 Elem. Diff. Equations 3 cr. BIOL 2170 Fund of Life Science II 4 cr. BIOL 2180 Fund of Life Science II Lab 1 cr. BIOE 1010 Professional Development 1 cr. BIOE 2100 BioE Thermodynamics 3 cr. CIVE 1150 Statics 3 cr. <b>Total 15 hours</b>	EECS 2300 Electric Circuits 4 cr. MIME 2300 or MATH 2890 3 cr. Hum./Soc. Sci./Multicultural Elective 6 cr.  <b>Total 13 hours</b>
<b>Pre-Junior Year</b>	BIOE 3940-001 Co-Op Experience # 1	BIOE 3110 Biomechanics 3 cr. BIOE 3300 Biomedical Electronics 4 cr. BIOE 4300 Analysis of BioE Systems 3 cr. ENGL 2950 Sci. & Tech. Rpt. Writing 3 cr. <b>Total 13 hours</b>	BIOE 3940-002 Co-Op Experience # 2
<b>Junior Year</b>	BIOE 3200 Physiology for Bioengineers 3 cr. BIOE 3400 Biotransport Phenomena 3 cr. BIOE 3500 Bioengineering Lab 3 cr. BIOE 4120 Biosignal Processing 3 cr. Technical Elective 3 cr. <b>Total 15 hours</b>	BIOE 3940-003 Co-Op Experience # 3	BIOE 4410 Design Project I 3 cr. Technical Elective 3 cr. Hum./Soc. Sci./Multicultural Elective 6 cr. <b>Total 12 hours</b>
<b>Senior Year</b>	BIOE 4420 Design Project II 3 cr. BIOE 3120 or BIOE 4200 3 cr. Technical Elective 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 12 hours</b>	Coursework for deficiencies, medical school prerequisites, business administration minor, graduate study or additional co-op experience.	

**Bioengineering Program - Plan B**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 Chemistry Lab I 1 cr. ENGL 1110 College Composition I 3 cr. BIOE 1000 Orientation & Intro to BioE 2 cr. <b>Total 14 hours</b>	CHEM 1240 General Chemistry II 4 cr. CHEM 1290 Chemistry Lab II 1 cr. MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Engineering Physics I 5 cr. BIOE 1200 Computer Prog. for Bioengr. 3 cr. <b>Total 17 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calc. 4 cr. PHYS 2140 General Physics II 5 cr. BIOL 2150 Fund of Life Science I 4 cr. BIOL 2160 Fund of Life Science Lab 1 cr. CIVE 1150 Statics 3 cr. <b>Total 17 hours</b>	MATH 3860 Elem. Diff. Equations 3 cr. BIOL 2170 Fund of Life Science II 4 cr. BIOL 2180 Fund of Life Science II Lab 1 cr. BIOE 1010 Professional Development 1 cr. BIOE 2100 BioE Thermodynamics 3 cr. BIOE 3110 Biomechanics 3 cr. <b>Total 15 hours</b>	EECS 2300 Electric Circuits 4 cr. MIME 2300 or MATH 2890 3 cr. Hum./Soc. Sci./Multicultural Elective 6 cr.  <b>Total 13 hours</b>
<b>Pre-Junior Year</b>	BIOE 2200 Biomaterials 3 cr. BIOE 3200 Physiology for Bioengineers 3 cr. BIOE 3400 Biotransport Phenomena 3 cr. BIOE 3500 Bioengineering Lab 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 15 hours</b>	BIOE 3940-001 Co-Op Experience # 1	ENGL 2950 Sci. & Tech. Rpt. Writing 3 cr. Technical Elective 3 cr. Hum./Soc. Sci./Multicultural Elective 6 cr. <b>Total 12 hours</b>
<b>Junior Year</b>	BIOE 3940-002 Co-Op Experience # 2	BIOE 3300 Biomedical Electronics 4 cr. BIOE 4300 Analysis of BioE Systems 3 cr. BIOE 4410 Design Project I 3 cr. Technical Elective 3 cr. <b>Total 13 hours</b>	BIOE 3940-003 Co-Op Experience # 3
<b>Senior Year</b>	BIOE 4120 Biosignal Processing 3 cr. BIOE 4420 Design Project II 3 cr. BIOE 3120 or BIOE 4200 3 cr. Technical Elective 3 cr. <b>Total 12 hours</b>	Coursework for deficiencies, medical school prerequisites, business administration minor, graduate study or additional co-op experience.	



### Degree Requirements

Students should follow and complete the degree requirements as displayed in the Bioengineering Program —Plan A, B or C (PreMed Option) charts.

### Bioengineering Program - Plan C (Accelerated PreMed Option)

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 Chemistry Lab I 1 cr. ENGL 1110 College Composition I 3 cr. BIOE 1000 Orient. & Intro to Bioengr. 2 cr. <b>Total 14 hours</b>	CHEM 1240 General Chemistry II 4 cr. CHEM 1290 Chemistry Lab II 1 cr. MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Engineering Physics I 5 cr. BIOE 1200 Comp. Prog. For Bioengr. 3 cr. BIOE 1010 Professional Development 1 cr. <b>Total 18 hours</b>	BIOE 3940-001 Co-op Experience # 1
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calc. 4 cr. PHYS 2140 Engineering Physics II 5 cr. BIOL 2150 Fund of Life Science I 4 cr. BIOL 2160 Fund of Life Science Lab I 1 cr. CHEM 2410 Organic Chemistry I 3 cr. CHEM 2460 Organic Chemistry Lab I 1 cr. <b>Total 18 hours</b>	MATH 3860 Differential Equations 3 cr. EECS 2300 Electric Circuits 4 cr. BIOL 2170 Fund of Life Science II 4 cr. BIOL 2180 Fund of Life Science Lab II 1 cr. CHEM 2420 Organic Chemistry II 3 cr. CHEM 2470 Organic Chemistry Lab II 1 cr. <b>Total 16 hours</b>	BIOE 3940-002 Co-Op Experience # 2
<b>Junior Year</b>	BIOE 2200 Biomaterials 3 cr. BIOE 3200 Physiology for Bioengineers 3 cr. BIOE 3500 Bioengineering Lab 3 cr. CIVE 1150 Statics 3 cr. ENGL 2950 Sci. & Tech. Rpt. Writing 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 18 hours</b>	BIOE 2100 BioE Thermodynamics 3 cr. BIOE 3110 Biomechanics 3 cr. BIOE 3300 Biomedical Electronics 4 cr. BIOE 4300 Analysis of BioE Systems 3 cr. MIME 2300 or MATH 2890 3 cr. <b>Total 16 hours</b>	BIOE 3940-003 Co-Op Experience # 3
<b>Senior Year</b>	BIOE 3400 Biotransport Phenomena 3 cr. BIOE 4120 Biosignal Processing 3 cr. BIOE 4410 Design Project I 3 cr. BIOE 3120 or BIOE 4200 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 15 hours</b>	BIOE 4420 Design Project II 3 cr. Technical Elective* 3 cr. Hum./Soc. Sci./ Multicultural Electives 9 cr. <b>Total 16 hours</b>	* Select carefully, the admission requirements for your selected medical school may have special requirements.

## 146 College of Engineering

- maintain at least a 3.5 GPA in bioengineering
- have a cumulative GPA of at least 3.5 upon graduation with a B.S. in bioengineering
- score at least a 27 on the Medical College Admissions Test (MCAT)
- successfully interview with the MCO faculty during their junior or senior year

A maximum of ten first-year students are selected for the program every year. The minimum requirements to qualify for this program are a high school GPA of at least 3.8/4.0 and an ACT score of 29 or equivalent SAT score. An application form to apply to the B.S./M.D. program is available on the department Web site: <http://www.bioe.eng.utoledo.edu/forms/BSMDapplication.pdf>

### Technical Electives

In addition to required courses, each student must complete at least 15 credit hours of technical electives. The first 6 credit hours must be chosen from one of the following sequences:

MATH 2890      Numerical Methods & Linear Algebra  
BIOE 4200      Biosystems & Control

MIME 2300      Engineering Dynamics  
BIOE 3120      Advanced Biomechanics

The remaining 9 credit hours are chosen from upper-level (3000-level and above) courses in engineering, mathematics or the natural sciences. Courses not shown below must receive approval from the faculty adviser to qualify as technical electives:

#### Cellular Engineering

BIOE 4610      Artificial Organs  
BIOL 3010      Molecular Genetics  
BIOL 3030      Cell Biology  
CHEE 4800      Polymer Science & Engineering  
CHEE 4820      Colloid/Surface Phenomena  
CHEM 2410      Organic Chemistry I  
CHEM 2420      Organic Chemistry II  
CHEM 3510      Biochemistry I  
CHEM 3520      Biochemistry II

#### Electronics & Communications

BIOE 4350      Biomedical Optics  
BIOE 4640      Medical Imaging  
BIOE 4810      Introduction to Nanotechnology  
BIOE 4820      Nanotechnology & Microfabrication  
EECS 3300      Probabilistic Methods  
EECS 3700      Electromagnetics  
EECS 4250      Robotics  
EECS 4360      Communication Systems  
EECS 4380      Digital Signal Processing  
PHYS 3070      Quantum Physics for Engineers

#### Materials, Mechanics & Manufacturing

BIOE 4710      Soft Tissue Biomechanics  
MIME 2600      Engineering Economics  
MIME 3300      Design of Mechanical Systems  
MIME 3370      Vibration & Control

MIME 4000      Engineering Statistics I  
MIME 4010      Engineering Statistics II  
MIME 4020      Quality Control & Management  
MIME 4050      Human Factors Engineering  
MIME 4330      Occupational Ergonomics

### Degree Requirements

Students should follow and complete the degree requirements as displayed in the bioengineering program - Plan A or bioengineering program - Plan B charts. Students who qualify for the accelerated premed program should follow the bioengineering - Plan C chart.

## Department of Chemical and Environmental Engineering

*Steven E. LeBlanc, chair*

### Degrees Offered

The department of chemical and environmental engineering offers an ABET-accredited program leading to the bachelor of science degree in chemical engineering (B.S.Ch.E.).

Chemical engineering is the application of the principles of chemistry, physics and mathematics to the economic conversion of raw materials into useful products. The curriculum provides a thorough grounding in basic and advanced chemistry, mathematics through differential equations and engineering physics. These courses are a firm foundation for engineering courses that include thermodynamics, fluid mechanics, heat and mass transfer, separations, reactor design, process control and pollution prevention. Additional courses in economics, communication skills, humanities, social sciences and various engineering electives broaden the curriculum and are capped by comprehensive chemical engineering design experiences.

The educational objectives of the chemical engineering program are that our graduates will:

- be prepared for professional careers in chemical engineering or to continue on with graduate or professional studies.
- demonstrate effective problem solving skills.
- be able to function effectively in a professional environment.

Chemical engineering graduates are in demand in many new and challenging fields. Chemical engineers are well suited to solve problems in many areas, including environmental engineering, polymers and materials engineering, nuclear power, petrochemicals, fertilizers, new food sources, pharmaceuticals, improved refining and chemical processes, computer simulation, mathematical modeling and bioengineering. Many students go on to graduate work in engineering, law, business and medicine. More information is available on the department Web site: <http://www.che.utoledo.edu>

### Degree Requirements

Students should follow and complete the degree requirements as displayed in the chemical and environmental engineering program — Plan A or the chemical and environmental engineering program — Plan B charts.

## Degree Requirements

Students should follow and complete the degree requirements as displayed in the Chemical Engineering Program —Plan A or Plan B charts.

### Chemical Engineering Program – Plan A

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 General Chemistry Lab I 1 cr. ENGL 1110 College Composition I 3 cr. CHEE 1000 Orientation and Computing for Chemical Engineering 3 cr. <b>Total 15 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. CHEE 1010 Professional Development 1 cr. CHEE 2010 Mass & Energy Balances 3 cr. CHEM 1240 General Chemistry II 4 cr. CHEM 1290 General Chemistry Lab II 1 cr. COMM 1010 Comm. Prin. & Prac. 3 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calc. 4 cr. PHYS 2130 Engineering Physics I 5 cr. CHEE 2230 CHEM Eng Thermo I 3 cr. CHEM 2410 Organic Chemistry I 3 cr. CHEM 2460 Organic Chemistry Lab I 1 cr. <b>Total 16 hours</b>	CHEE 3940-001 Co-Op Experience # 1	MATH 3860 Differential Equations 3 cr. CHEE 3030 Separation Process 3 cr. CHEE 2110 Process Fluid Mechanics 3 cr. CHEM 2420 Organic Chemistry II 3 cr. CHEM 2470 Organic Chemistry Lab II 1 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 16 hours</b>
<b>Pre-Junior Year</b>	CHEE 3940-002 Co-Op Experience # 2	ENGL 2950 Sci & Tech Report Wrtg 3 cr. CHEE 2330 CHEM Eng Thermo II 3 cr. CHEE 3110 Heat Transfer 2 cr. CHEE 3120 Mass Transfer 3 cr. Advance Chemistry Elective 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 17 hours</b>	CHEE3940-003 Co-Op Experience # 3
<b>Junior Year</b>	PHYS 2140 Engineering Physics II 5 cr. MIME 2600 Engineering Economics 3 cr. CHEE 3400 Process Dynamics & Control 3 cr. CHEE 3300 Reactor Design 3 cr. Advanced Chemistry Elective 3 cr. <b>Total 17 hours</b>	CHEE 3940-004 Co-Op Experience # 4	CIVE 1150 or EECS 2340 Eng. Elective 3 cr. CHEE 4110 Pollution Prevention 3 cr. CHEE 4500 Chem. Eng. Laboratory I 2 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. Free Elective 3 cr. <b>Total 14 hours</b>
<b>Senior Year</b>	Advanced Science Elective 3 cr. Engineering Electives 6 cr. CHEE 4540 Chemical Eng. Design 3 cr. CHEE 4550 CHEM Eng. Laboratory II 2 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 17 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

### Chemical Engineering Program – Plan B

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 General Chemistry Lab I 1 cr. ENGL 1110 College Composition I 3 cr. CHEE 1000 Orientation and computing for Chemical Engineering 3 cr. <b>Total 15 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. CHEE 1010 Professional Development 1 cr. CHEE 2010 Mass & Energy Balances 3 cr. CHEM 1240 General Chemistry II 4 cr. CHEM 1290 General Chemistry Lab II 1 cr. COMM 1010 Comm. Prin. & Prac. 3 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calc. 4 cr. PHYS 2130 Engineering Physics I 5 cr. CHEE 2230 CHEM Eng Thermo I 3 cr. CHEM 2410 Organic Chemistry I 3 cr. CHEM 2460 Organic Chemistry Lab I 1 cr. <b>Total 16 hours</b>	MATH 3860 Differential Equations 3 cr. CHEE 2330 CHEM Eng Thermo II 3 cr. CHEE 3030 Separation Process 3 cr. CHEM 2420 Organic Chemistry II 3 cr. CHEM 2470 Organic Chemistry Lab II 1 cr. ENGL 2950 Sci & Tech Report Writing 3 cr. <b>Total 16 hours</b>	CHEE 3940-001 Co-Op Experience # 1
<b>Pre-Junior Year</b>	PHYS 2140 Engineering Physics II 5 cr. MIME 2600 Engineering Economics 3 cr. CHEE 2110 Process Fluid Mechanics 3 cr. CHEE 3300 Reactor Design 3 cr. Advanced Chemistry Elective 3 cr. <b>Total 17 hours</b>	CHEE 3940-002 Co-Op Experience # 2	CIVE 1150 or EECS2340 3 cr. CHEE 4110 Pollution Prevention 3 cr. CHEE 3400 Process Dynamics & Control 3 cr. Hum./Soc. Sci./Multicultural Elective 6 cr. <b>Total 15 hours</b>
<b>Junior Year</b>	CHEE 3940-003 Co-Op Experience # 3	CHEE 3110 Heat Transfer 3 cr. CHEE 3120 Mass Transfer 2 cr. CHEE 4500 CHEM Eng. Laboratory I 2 cr. Hum. /Soc. Sci./Multicultural Elective 3 cr. Advanced Chemistry Elective 3 cr. Engineering Elective 3 cr. <b>Total 16 hours</b>	CHEE 3940-004 Co-Op Experience # 4
<b>Senior Year</b>	Advanced Science Elective 3 cr. Engineering Electives 3 cr. CHEE4540 Chemical Eng. Design 3 cr. CHEE4550 CHEM Eng. Laboratory II 2 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. Free Elective 3 cr. <b>Total 17 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

## Electives

### Free Electives

Three hours of free electives are required. Free electives are any courses at the University that broaden your background in an area of interest. Courses that are considered remedial for engineering students may not be used to satisfy this requirement. If you have questions on this requirement, check with your academic adviser for details.

### Engineering Electives

Twelve hours of engineering electives are required, including MIME 2600 Engineering Economics. Students must also take either CIVE 1150 Engineering Mechanics: Statics or EECS 2340 Circuits for Non-Majors. An additional 6 hours may be chosen from engineering courses offered within the College of Engineering. Recommended courses include CIVE 1160 Strength of Materials, CIVE 3620 Air Pollution Engineering I, CIVE 4680 Environmental Law, or any 4000-level chemical engineering elective course. Students should see the departmental Web page (<http://www.che.utoledo.edu>) for a list of current courses, and consult their adviser before selecting engineering electives.

### Advanced Chemistry and Science Electives

Nine hours of advanced science electives are required. Students may choose 3000/4000 level courses from the following departments: chemistry, physics, biology, and earth, ecological and environmental sciences. At least 6 hours of advanced chemistry is required. Students should select courses from recommended science sequences such as:

Biochemistry	(CHEM 3510/3520 Biochemistry I & II)
Environmental	(CHEM 3510/3610 Biochemistry I & Inorganic Chemistry I; GEOL 4220 Environmental Geochemistry)
Physical	(CHEM 3740/3860 Physical Chemistry II & Advanced Lab I; CHEM 4980 Principles of Materials Science)
Analytical	(CHEM 3310/3360/3860/4300 Analytical Chemistry, Analytical Chemistry Lab, Advanced Chemistry Lab I, and Instrumental Analysis).

Additional courses that may be used to fulfill the advanced science requirement include:

EEES 4450	Hazardous Waste Management
EEES 3050/3060	Ecology & Ecology Lab
PHYS 3070	Quantum Physics for Engineers
CHEM 4980	Materials Science I
CHEE 4800	Polymer Science and Engineering
CHEE 4980	Polymeric Materials

Students should meet with the academic adviser to develop a course sequence that is tailored to the individual academic goals of their programs.

### Environmental Engineering Electives

Current industrial needs require that all chemical engineers be aware of environmental issues when designing new chemical facilities or modifying existing ones. The environmental option allows chemical engineering students to apply engineering principles in the development of environmentally conscious chemical processes. Greater background

in the sciences is provided in this program to allow the environmental specialist increased flexibility in understanding the environmental impact of current or proposed new practices. Specific examples of existing concepts are provided to demonstrate current practice. The trend toward pollution prevention is emphasized.

Upon completion of these electives, the environmental chemical engineer will be able to analyze chemical processes for their environmental impact, suggest modifications to processes to minimize the production of wastes and develop treatment alternatives. The environmental chemical engineer provides an important bridge between the process engineer and the waste treatment specialist.

The goals of this sequence are achieved through careful choice of the electives, without additional hours beyond those normally required for graduation. The sequence of recommended electives is:

<b>Advanced Chemistry Electives:</b>	CHEM 3510	Biochemistry I
	CHEM 3610	Inorganic Chemistry I
<b>Advanced Science Electives:</b>	EEES 3050	Ecology
	EEES 3060	Ecology Laboratory
	EEES 4450	Hazardous Waste Management
	EEES 4220	Environmental Geochemistry
<b>Engineering Electives:</b>	CHEE 4160	Industrial Waste Treatment
	CHEE 4170	Process Waste Treatment
	CIVE 4680	Environmental Law

Students should see an adviser for more information about this option.

### Polymer Engineering Electives

Polymers and plastics are extremely important materials in today's society. The volume of plastics used annually exceeds that of steel and aluminum. Chemical engineers with an expertise in polymers and plastics are in demand. Concepts that chemical engineers specializing in this area need to be familiar with include polymer synthesis and chemistry, polymer processing (mixing, extrusion, blow molding and injection molding), and polymer blends and composites. The polymer engineering sequence will enable students to apply their engineering skills to this important field and gather the necessary experience and expertise to work in the polymer industry upon graduation.

Recommended polymer engineering electives include:

CHEE 4800	Polymer Science & Engineering
CHEE 4850	Properties of Polymer Systems
CHEE 4980	Polymeric Materials

For a complete list of courses in the polymer engineering sequence, see your adviser or consult the departmental Web page: (<http://www.che.utoledo.edu>).

## Department of Civil Engineering

*Brian W. Randolph, chair*

### Degrees Offered

The department of civil engineering offers an ABET-accredited program leading to the bachelor of science degree in civil engineering (B.S.C.E.). A graduate of this program meets the requirements to sit for the exam leading to registration as a professional engineer.

Civil engineering can be considered as the composite of structural, geotechnical, environmental and transportation engineering. All involve the application of basic scientific principles to the planning, design and construction of public facilities.

The goal of the program is to prepare students for professional careers and/or graduate study in civil engineering. This is achieved through a balanced curriculum of mathematics and physical sciences, fundamentals of engineering, specific courses in environmental, geotechnical, structural and transportation areas, as well as humanities, social sciences and multicultural studies. Individual specialization is achieved through the selection of elective courses. The course of study culminates in a comprehensive senior design project.

We prepare civil engineering students to be productive contributors to an increasingly technical society, but with an appreciation for the broader societal issues in which technical decisions are made. Each student is taught to apply basic scientific principles to the planning, design and construction of public facilities. Students are expected to gain a broad understanding of technical fundamentals, to increase problem-solving skills and to develop professional attitudes and abilities. Through laboratory experiences, our students are able to make measurements on and to interpret data obtained from physical phenomena. Opportunities for our students to work on a variety of group projects, to prepare written reports and to make oral presentations are all used to develop communication skills and teamwork throughout the curriculum.

The cooperative education experiences of our students provide them with real-world work experiences that introduce them to the practice of civil engineering while placing their academic studies in a realistic context with social and fiscal constraints. Graduates of our program are prepared for positions of increasing responsibility, and ultimately leadership, as practicing civil engineers in industry and government agencies. Students also develop an appreciation of the need for continued, life-long learning to keep pace with the rapidly expanding body of knowledge available to them. Our B.S.C.E. program graduates have the preparation needed for continued study in graduate school or other forms of continued learning.

To summarize, the educational objectives of our program are to provide graduates with:

- the broad technical knowledge in environmental, geotechnical, structural and transportation subjects needed to begin practice as a civil engineer in industry or government;
- an understanding of the need for life-long learning, and the preparation to continue their education, many at the graduate level;
- the ability to use current equipment, computers and specialized software packages for the analysis and solution of civil engineering problems;

- the ability to think and learn independently, while still functioning effectively in a team environment;
- the ability to effectively communicate their work and ideas, both orally and in writing, using current technology;
- the ability to conduct experiments in a range of civil engineering subjects, as well as analyze and interpret data;
- an understanding of their professional and ethical responsibilities as civil engineers and the importance of professional licensure;
- a historical consciousness, social awareness, and an ability to think in an aesthetic mode; and
- an ability to perform civil engineering design with an appreciation for applicable codes, fiscal and social constraints and the role of construction professionals.

More information is available on the departmental Web site: <http://www.eng.utoledo.edu/civil/>.

### Degree Requirements

Students should follow and complete the degree requirements as displayed in the civil engineering program — Plan A or the civil engineering program — Plan B charts.

### Electives

Each civil engineering student selects electives from four general areas: at least 15 credit hours in the humanities, social sciences and multicultural studies; at least 3 credit hours in college composition; at least 3 credit hours in fundamentals of engineering; and at least 6 credit hours of technical electives. Recommended lists of college composition, fundamentals of engineering and technical electives are given below. Technical electives not listed below must be at the 3000 or 4000 level and approved by the student's adviser.

### College Composition Electives

ENGL 2950 Scientific and Technical Report Writing  
ENGL 2960 Organizational Report Writing

### Fundamentals of Engineering Electives

EECS 2340 Electric Circuits for Nonmajors  
MIME 1650 Materials & Engineering  
MIME 3400 Intro to Thermal Sciences

### Technical Electives

#### Structural Engineering (Analysis)

CIVE 3320 Basic Finite Element Methods  
CIVE 4300 Advanced Mechanics of Materials  
CIVE 4320 Matrix Analysis of Structures  
CIVE 4340 Experimental Mechanics  
CIVE 4350 Introduction to Structural Dynamics

#### Structural Engineering (Design)

CIVE 4410 Timber Design  
CIVE 4430 Structural Steel Design II  
CIVE 4440 Reinforced Concrete Design II  
CIVE 4480 Reinforced Masonry Design

**Degree Requirements**

Students should follow and complete the degree requirements as displayed in the Civil Engineering Program —Plan A or Plan B charts.

**Civil Engineering Program - Plan A**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	CIVE 1000 Freshman Civil Eng. Exp. 1 cr. CIVE 1100 Msmts & CAD for Civil Eng. 4 cr. MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 Chemistry Lab I 1 cr. ENGL 1110 College Composition I 3 cr. <b>Total 17 hours</b>	CIVE 2000 Professional Development 1 cr. MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Engineering Physics I 5 cr. ENGL 2950 or 2960 Report Writing. 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2890 Numerical Meth & Linear Alg 3 cr. MATH 2850 Elem. Multivariable Calculus 4 cr. PHYS 2140 Engineering Physics II 5 cr. CIVE 1150 Engineering Statics 3 cr. EECS 1050 Intro to Computing in C/C++ 2 cr. <b>Total 17 hours</b>	CIVE 3940-001 Co-Op Experience # 1	MATH 3860 Differential Equations 3 cr. CIVE 1160 Mechanics of Materials 3 cr. CIVE 1170 Fluid Mech. For Civil Engr. 3 cr. MIME 2300 Engineering Dynamics 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 15 hours</b>
<b>Pre-Junior Year</b>	CIVE 3940-002 Co-Op Experience # 2	CIVE 2110 Civil Engr. Materials with Lab 3 cr. CIVE 2120 Civil Engr. Systems Analysis 3 cr. CIVE 3310 Structural Analysis 3 cr. CIVE 3610 Environmental Engineering I 3 cr. CIVE 3620 Air Pollution Engineering I 3 cr. MIME 4000 Engineering Statistics 3 cr. <b>Total 18 hours</b>	CIVE 3940-003 Co-Op Experience # 3
<b>Junior Year</b>	CIVE 3210 Soil Mechanics 3 cr. CIVE 3510 Transportation Engineering 3 cr. CIVE 3420 Reinforced Concrete Design I 3 cr. MIME 2600 Engineering Economics 3 cr. Fundamentals of Engineering Elective 3 cr. <b>Total 15 hours</b>	CIVE 3940-004 Co-Op Experience # 4	CIVE 3220 Foundation Engineering 3 cr. CIVE 3410 Steel Design I 3 cr. CIVE 3520 Transportation Engineering II 3 cr. CIVE 3630 Environmental Engineering II 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 15 hours</b>
<b>Senior Year</b>	CIVE 4750 Senior Design Project 3 cr. Technical Electives 6 cr. Hum./Soc. Sci./Multicultural Elective 6 cr. <b>Total 15 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

**Civil Engineering Program – Plan B**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 Chemistry Lab I 1 cr. ENGL 1110 College Composition I 3 cr. CIVE 1000 Freshman Civil Eng. Exper. 1 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 16 hours</b>	CIVE 1100 Msmts & CAD for Civil Engr. 4 cr. CIVE 2000 Professional Development 1 cr. MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Engineering Physics I 5 cr. ENGL 2950 or 2960 Report Writing. 3 cr. <b>Total 17 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calculus 4 cr. MATH 2890 Numerical Meth & Linear Alg 3 cr. PHYS 2140 Engineering Physics II 5 cr. CIVE 1150 Engineering Statics 3 cr. EECS 1050 Intro to Computing in C/C++ 2 cr. <b>Total 17 hours</b>	MATH 3860 Differential Equations 3 cr. CIVE 1160 Mechanics of Materials 3 cr. CIVE 1170 Fluid Mech. For Civil Engr. 3 cr. MIME 2300 Engineering Dynamics 3 cr. Fundamentals of Engineering Elective 3 cr. <b>Total 15 hours</b>	CIVE 3940-001 Co-Op Experience # 1
<b>Pre-Junior Year</b>	CIVE 2110 Civil Engr. Materials w/ Lab 3 cr. CIVE 3210 Soil Mechanics 3 cr. CIVE 3310 Structural Analysis 3 cr. CIVE 3510 Transportation Engineering I 3 cr. CIVE 3610 Environmental Engineering I 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 18 hours</b>	CIVE 3940-002 Co-Op Experience # 2	CIVE 3220 Foundation Engineering 3 cr. CIVE 3410 Steel Design I 3 cr. CIVE 3520 Transportation Engineering II 3 cr. MIME 4000 Engineering Statistics 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 15 hours</b>
<b>Junior Year</b>	CIVE 3940-003 Co-Op Experience # 3	CIVE 3420 Reinforced Concrete Design 3 cr. CIVE 2120 Civil Engr Systems Analysis 3 cr. CIVE 3620 Air Pollution Engineering 3 cr. CIVE 3630 Environmental Engineering II 3 cr. Technical Elective 3 cr. <b>Total 15 hours</b>	CIVE 3940-004 Co-Op Experience # 4
<b>Senior Year</b>	CIVE 4750 Senior Design Project 3 cr. MIME 2600 Engineering Economics 3 cr. Technical Elective 3 cr. Hum./Soc. Sci./Multicultural Electives 6 cr. <b>Total 15 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

## Environmental Engineering

CHEM	3400	Organic Chemistry I
EEES	4410	Hydrogeology
CIVE	4610	Hydrology and Water Resources
CIVE	4620	Open Channel Flow Hydraulics
CIVE	4630	Indoor Air Quality
CIVE	4640	Industrial Hygiene
CIVE	4650	Industrial Ventilation
CIVE	4660	Pollution Laboratory
CIVE	4670	Solid Waste Management and Disposal
CIVE	4680	Environmental Law

## Transportation Engineering

GEPL	3410	Cartography I
GEPL	4530	Principles of Urban Planning
CIVE	4510	Materials Engineering
CIVE	4550	Traffic Control
CIVE	4580	Introduction to Intelligent Transportation Systems

## Geotechnical Engineering

EEES	3250	Engineering Geology
EEES	3320	Structural Geology
EEES	4610	Introduction to Geophysics
CIVE	4210	Advanced Soil Mechanics
CIVE	4220	Advanced Foundation Engineering
CIVE	4240	Design With Geosynthetics
CIVE	4260	Experimental Soil Mechanics

## Other Technical Electives

CIVE	4710	Advanced Engineering Systems Analysis
CIVE	4810	Contracts and Specifications
CIVE	4820	Project Management
CIVE	4830	Engineering Ethics and Professionalism
CIVE	4840	GIS for Civil Engineering
CIVE	4900	Seminars in Civil Engineering
CIVE	4960	Honors Thesis Research

## Department of Electrical Engineering and Computer Science

*Demetrios Kazakos, chair*

### Degrees Offered

Two degree programs are offered through the department of electrical engineering and computer science. These are the bachelor of science in computer science and engineering (C.S.E.) and the bachelor of science in electrical engineering (E.E.). These programs rely on a common scientific and mathematical foundation and possess common interests in electric circuits, electronics, signals and systems and computer-based systems. The C.S.E. program places greater emphasis on computer science and computer-related applications, including computer systems design, programming languages, networking and software engineering, while the E.E. program emphasizes computer hardware, electrical principles and related applications such as electronics design, microelectronics, energy systems, automatic control systems, signal analysis and communications. Both programs are accredited by the Engineering Accreditation Commission (EAC) of ABET. The C.S.E. degree also is accredited by the Computing Accreditation Commission (CAC) of ABET.

All engineering programs require humanities, social sciences and multicultural core electives. More detailed information is available in the departmental office and also may be accessed using the departmental Web page at: <http://www.eecs.utoledo.edu>.

### Advanced Placement

Students with a score of 3, 4 or 5 on the Computer Science A test receive credit for EECS 1530 (3 hours).

## Computer Science and Engineering Degree Requirements

The educational objectives of the computer science and engineering program are that graduates

- will possess a strong foundation in computer science and computer engineering;
- are employable in the computer science and computer engineering professions with duties including the analysis, design, implementation, application and management of computer systems;
- communicate effectively in a professional setting, exhibit good professional and ethical behavior, and build reputations of integrity;
- are well prepared to pursue graduate studies; and
- are able to adapt to changing professional situations through continuous learning and recognize the important role of professional societies.

The College of Engineering has instituted a co-op program that requires three or more work experiences. Students should follow and complete the degree requirements as displayed in the computer science and engineering program — Plan A or Plan B charts. Students should consult an adviser for additional information.

The curriculum has a requirement of 9 hours of professional electives. Students are required to develop a plan of study for the professional elective courses with their C.S.E. program adviser. The combination of electives selected and required advanced courses (EECS 2550 Operating Systems and Systems Programming, EECS 3550 Software Engineering, EECS 3100 Microsystems Design, EECS 3150 Data Communications and EECS 3500 Automata and Language Translation Systems) provide in-depth coverage of at least three advanced C.S.E. specialization areas. A current list of approved professional electives for the program may be obtained from the departmental office or from the departmental Web page: <http://www.eecs.utoledo.edu>.

The humanities/fine arts, social science and multicultural electives must be chosen so that they complete the University Core Curriculum and the requirements of the College of Engineering. Students should consult with their adviser.

## Electrical Engineering Degree Requirements

The educational objectives of the electrical engineering program are that

- all graduates of the EE program will begin a professional career in EE or an allied field;
- all graduates will be equipped to engage in lifelong learning;

**Degree Requirements**

Students should follow and complete the degree requirements as displayed in the Computer Science and Engineering Program–Plan A or Plan B charts. Students should consult an advisor for additional information

**Computer Science and Engineering Program – Plan A**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. ENGL 1110 College Composition I 3 cr. EECS 1000 Orientation to EECS 1 cr. EECS 1530 Intro. to Programming 3 cr. <b>Total 15 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Physics for Sci & Eng. I 5 cr. EECS 2000 Professional Development 1 cr. EECS 1100 Digital Logic Design 4 cr. EECS 1540 Discrete & Linear Structures 4 cr. <b>Total 18 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivrble Calculus 4 cr. PHYS 2140 Physics for Sci & Eng. II 5 cr. EECS 2100 Comp Org & Assembly 4 cr. EECS 1550 Nonlinear Data Structures 4 cr. <b>Total 17 hours</b>	EECS 3940:001 Co-Op Experience # 1	MATH 3860 Elem Differential Equations 3 cr. MATH 2890 Numeric Meth & Linear Alg 3 cr. EECS 2300 Electric Circuits 4 cr. EECS 2550 Op Systems & Sys Prog 3 cr. Hum/Soc/Multicultural Elective 3cr. <b>Total 16 hours</b>
<b>Pre-Junior Year</b>	EECS 3940:002 Co-Op Experience # 2	ENGL 2960 Organizational Report Writing or ENGL 2950 Sci & Tech Report Wrtg 3 cr. EECS 3400 Electronics I 4 cr. EECS 3200 Signals & Systems 4 cr. MIME 4000 Engineering Statistics I 3 cr. EECS 3550 Software Engineering 3 cr. <b>Total 17 hours</b>	EECS 3940:003 Co-Op Experience # 3
<b>Junior Year</b>	EECS 3150 Data Communication 3 cr. MIME 3400 Intro to Thermal Sciences or CIVE 1150 Statics 3 cr. EECS 3100 Microsystem Design 4 cr. EECS 3500 Automata & Lang. Trans. 3 cr. ECON 1200 Microeconomics or ECON 1150 Macroeconomics 3 cr. <b>Total 16 hours</b>	Hum/Soc/Multicultural Elective 7 cr. EECS Professional Elective 3 cr. EECS 4000 Senior Design Project 4 cr. <b>Total 14 hours</b>	EECS 3940:004 Co-Op Experience # 4
<b>Senior Year</b>	Hum/Soc/Multicultral Elective 9 cr. EECS Professional Electives 6 cr. <b>Total 15 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

**Computer Science and Engineering Program - Plan B**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. ENGL 1110 College Composition I 3 cr. EECS 1000 Orientation to EECS 1 cr. EECS 1530 Intro. to Programming 3 cr. <b>Total 15 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Physics for Sci & Eng. I 5 cr. EECS 2000 Professional Development 1 cr. EECS 1100 Digital Logic Design 4 cr. EECS 1540 Discrete & Linear Structures 4 cr. <b>Total 18 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivrble Calculus 4 cr. PHYS 2140 Physics for Sci & Eng. II 5 cr. EECS 2100 Comp Org & Assembly 4 cr. EECS 1550 Nonlinear Data Structures 4 cr. <b>Total 17 hours</b>	MATH 3860 Elem Differential Equations 3 cr. MATH 2890 Numeric Meth & Linear Alg 3 cr. EECS 2300 Electric Circuits 4 cr. EECS 2550 Op Systems & Sys Prog 3 cr. ENGL 2960 Organizational Report Writing or ENGL 2950 Sci & Tech Report Wrtg 3 cr. <b>Total 16 hours</b>	EECS 3940:001 Co-Op Experience # 1
<b>Pre-Junior Year</b>	ECON 1200 Microeconomics or ECON 1150 Macroeconomics 3 cr. EECS 3400 Electronics I 4 cr. EECS 3200 Signals & Systems 4 cr. Hum/Soc/Multicultural Elective 3 cr. EECS 3550 Software Engineering 3 cr. <b>Total 17 hours</b>	EECS 3940:002 Co-Op Experience # 2	EECS 3150 Data Communication 3 cr. MIME 3400 Intro to Thermal Sciences or CIVE 1150 Statics 3 cr. EECS 3100 Microsystem Design 4 cr. EECS 3500 Automata & Language Translation Systems 3 cr. MIME 4000 Engineering Statistics I 3 cr. <b>Total 16 hours</b>
<b>Junior Year</b>	EECS 3940:003 Co-Op Experience # 3	Hum/Soc/Multicultural Elective 7 cr. EECS Professional Elective 3 cr. EECS 4000 Senior Design Project 4 cr. <b>Total 14 hours</b>	EECS 3940:004 Co-Op Experience # 4
<b>Senior Year</b>	Hum/Soc/Multicultral Elective 9 cr. EECS Professional Electives 6 cr. <b>Total 15 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	



**Degree Requirements**

Students should follow and complete the degree requirements as displayed in the Electrical Engineering Program --Plan A or Plan B charts. Students should consult an advisor for additional information

**Electrical Engineering Program – Plan A**

	<b>Fall Semester</b>	<b>Spring Semester</b>	<b>Summer Semester</b>
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry 4 cr. ENGL 1110 College Composition I 3 cr. EECS 1000 Orientation to EECS 1 cr. EECS 1100 Digital Logic Design 4 cr. <b>Total 16 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Physics for Sci & Eng. I 5 cr. EECS 2000 Professional Development 1 cr. EECS 1530 Intro. to Programming 3 cr. ENGL 2950 Tech Writing or ENGL 2960 Org. Report Writing 3 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calc. 4 cr. PHYS 2140 Physics for Sci & Eng. II 5 cr. EECS 2100 Comp Org & Assembly 4 cr. ECON 1200 Microeconomics 3 cr. <b>Total 16 hours</b>	EECS 3940:001 Co-Op Experience # 1	MATH 3860 Elem Differential Equations 3 cr. MATH 2890 Num. Methods & Linear Alg 3 cr. EECS 2300 Electric Circuits 4 cr. Hum./Soc. Sci./Multicultural Elective 6 cr. <b>Total 16 hours</b>
<b>Pre-Junior Year</b>	EECS 3940:002 Co-Op Experience # 2	EECS 3400 Electronics I 4 cr. EECS 3200 Signals & Systems 4 cr. EECS 3700 Electromagnetics 4 cr. MIME 3400 Intro to Thermal Sci or CIVE 1150 Statics 3 cr. <b>Total 15 hours</b>	EECS 3940:003 Co-Op Experience #3
<b>Junior Year</b>	EECS 3100 Microsystems Design 4 cr. EECS 3300 Probabilistic Methods 3 cr. EECS 3420 Electronics II 3 cr. EECS 3460 Energy Conversion 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 16 hours</b>	EECS 3440 Electronic Lab 1 cr. EECS 4360 Communication Systems 3 cr. EECS 4200 Feedback Control Systems 3 cr. EECS 4130 Digital Design 4 cr. EECS Technical Electives 6 cr. <b>Total 17 hours</b>	EECS 3940:004 Co-Op Experience # 4
<b>Senior Year</b>	EECS 4000 Senior Design 4 cr. EECS 4480 Elec. Energy Process 3 cr. EECS Technical Electives 6 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 16 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

**Electrical Engineering Program – Plan B**

	<b>Fall Semester</b>	<b>Spring Semester</b>	<b>Summer Semester</b>
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry 4 cr. ENGL 1110 College Composition I 3 cr. EECS 1000 Orientation to EECS 1 cr. EECS 1100 Digital Logic Design 4 cr. <b>Total 16 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. PHYS 2130 Physics for Sci & Eng. I 5 cr. EECS 2000 Professional Development 1 cr. EECS 1530 Introduction to Programming 3 cr. ENGL 2950 or 2960 Report Writing 3 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calc. 4 cr. PHYS 2140 Physics for Sci & Eng. II 5 cr. EECS 2100 Comp Org & Assembly 4 cr. ECON 1200 Microeconomics 3 cr. <b>Total 16 hours</b>	MATH 3860 Elem Differential Equations 3 cr. MATH 2890 Num. Methods & Linear Alg 3 cr. EECS 2300 Electric Circuits 4 cr. Hum./Soc. Sci./Multicultural Electives 6 cr. <b>Total 16 hours</b>	EECS 3940:001 Co-Op Experience # 1
<b>Pre-Junior Year</b>	EECS 3400 Electronics I 4 cr. EECS 3200 Signals & System 4 cr. EECS 3700 Electromagnetics 4 cr. MIME 3400 Intro to Thermal Sci or CIVE 1150 Statics 3 cr. <b>Total 15 hours</b>	EECS 3940:002 Co-Op Experience # 2	EECS 3300 Probabilistic Methods 3 cr. EECS 3420 Electronics II 3 cr. EECS 3460 Energy Conversion 3 cr. EECS 3100 Microsystems Design 4 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 16 hours</b>
<b>Junior Year</b>	EECS 3940:003 Co-Op Experience #3	EECS 3440 Electronic Lab 1 cr. EECS 4360 Communication Systems 3 cr. EECS 4200 Feedback Control Systems 3 cr. EECS 4130 Digital Design 4 cr. EECS Technical Electives 6 cr. <b>Total 17 hours</b>	EECS 3940:004 Co-Op Experience # 4
<b>Senior Year</b>	EECS 4000 Senior Design 4 cr. EECS 4480 Elec. Energy Process 3 cr. EECS Technical Electives 6 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 16 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

- all graduates will exhibit good ethics and become full participants in the appropriate professional and technical societies;
- all graduates will have good oral and written communication and reporting skills, and
- many graduates will establish a recognized level of competence in a specialty of EE within a few years of their graduation; others will continue on with their graduate education.

The College of Engineering has instituted a co-op program that requires three or more work experiences. Students should follow and complete the degree requirements as displayed in the electrical engineering program — Plan A or Plan B charts. Students should consult an adviser for additional information.

The curriculum has a requirement of 12 hours of technical electives. Students are required to develop a plan of study for the technical elective courses with the E.E. program adviser. A current list of approved technical electives for the program may be obtained from the departmental office or from the departmental Web page at: <http://www.eecs.utoledo.edu>.

## Department of Mechanical, Industrial and Manufacturing Engineering

*Abdollah A. Afjeh, interim chair*

### Degrees Offered

The department of mechanical, industrial and manufacturing engineering offers ABET-accredited programs leading to the bachelor of science in industrial engineering (B.S.I.E.) and bachelor of science in mechanical engineering (B.S.M.E.) degrees.

The goal of the B.S.I.E. and B.S.M.E. programs is to prepare our students for successful professional careers in their chosen fields of study, with emphasis on industrial or mechanical and/or manufacturing engineering. We fulfill this goal through a carefully constructed, effectively implemented and continuously evolving curriculum that satisfies the detailed incremental objectives leading to appropriate terminal objectives. This is accomplished by providing technical knowledge, increasing creative skills and developing professional attitudes through courses designed with a balance of mathematics, basic sciences, fundamental and specialized engineering courses, humanities/fine arts, social science, and multicultural courses. Specifically, our program educational objectives are that engineers graduating from The University of Toledo department of mechanical, industrial and manufacturing engineering will be individuals who

- are able to define engineering problems, identify research needs and evaluate the results in an environmental, economic and societal context;
- design products, processes and systems either independently or as part of a team;
- creatively apply mathematical, scientific, and engineering principles and modern techniques in solving engineering problems;
- have the necessary communication and interpersonal skills to function as an engineer;
- understand their ethical and professional responsibilities;
- are familiar with contemporary and global issues and the importance of cultural and ethnic diversity; and

- appreciate the need for life-long learning to enhance their professional skills and to enrich their lives.

Industrial engineering deals with the development of better ways to cost effectively produce products with improved quality, safety and reliability, as well as determine the most efficient way to perform tasks needed in the business world. This is an exciting and broad field involving high-level technology, manufacturing systems, management and people.

Mechanical engineering deals with design, computer-aided design, development, manufacturing, testing, research, maintenance, applications and sales. Mechanical engineering is the largest field in engineering, employing over one-fourth of all engineers. This broad and diverse field also provides a strong foundation for pursuing a law, business or medical degree and affords many advantages in the professional world.

### Degree Requirements

#### Bachelor of Science in Industrial Engineering

Students should follow and complete the degree requirements as displayed in the industrial engineering program — Plan A chart.

#### Bachelor of Science in Mechanical Engineering

Students should follow and complete the degree requirements as displayed in the mechanical engineering program — Plan A, or the mechanical engineering program — Plan B charts.

### Technical Electives

The following technical electives, as well as additional courses from MIME and other engineering programs, are available to MIME undergraduate students. Appropriate numbers of technical electives are to be chosen by students from the following list in consultation with their academic adviser.

MIME 4210	Vehicle Dynamics .....	3
MIME 4230	Dynamics of Human Movement .....	3
MIME 4270	CAD-Geometric Modeling .....	3
MIME 4280	CAD-Finite Element Methods .....	3
MIME 4300	Advanced Mechanics of Materials .....	3
MIME 4310	Mechanics of Composite Materials .....	3
MIME 4320	Fatigue of Materials & Structures .....	3
MIME 4330	Occupational Ergonomics .....	3
MIME 4340	Experimental Mechanics .....	3
MIME 4510	Turbomachinery .....	3
MIME 4520	Heating, Ventilating & Air Conditioning .....	3
MIME 4530	Internal Combustion Engines .....	3
MIME 4540	Jet Propulsion .....	3
MIME 4550	Aerodynamics .....	3
MIME 4560	Gas Dynamics .....	3
MIME 4580	Design of Thermal Systems .....	3
MIME 4590	Lubrication Technology & Bearing Design .....	3
MIME 4640	Random Processes .....	3
MIME 4690	Reliability .....	3
MIME 4730	Forecasting .....	3
MIME 4780	Adv Engrg Economy & Decision Theory .....	3
MIME 4800	Design for Manufacturability .....	3
MIME 4810	Material Removal Processes .....	3

## Degree Requirements

Students should follow and complete the degree requirements as displayed in the Industrial Engineering Program – Plan A Chart

### Industrial Engineering Program – Plan A

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. ENGL 1110 College Composition I 3 cr. MIME 1000 Orientation to ME and IE 3 cr. MIME 1100 Introduction to CAD 2 cr. <b>Total 16 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. MIME 1010 Professional Development 1 cr. MIME 1650 Materials Science & Engr. 3 cr. PHYS 2130 Engineering Physics I 5 cr. ENGL 1930 Tech. Writing for Engineers 1 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calculus 4 cr. PHYS 2140 Engineering Physics II 5 cr. CIVE 1150 Engineering Statics 3 cr. MIME 2650 Manufacturing Processes 3 cr. <b>Total 15 hours</b>	MIME 3940-001 Co-Op Experience # 1	MATH 3860 Differential Equations 3 cr. MATH 2890 Num Methods & Linear Alg. 3 cr. MIME 4000 Engineering Statistics I 3 cr. MIME 2300 Engineering Dynamics 3 cr. PSY 1010 Principles of Psychology 3 cr. <b>Total 15 hours</b>
<b>Pre-Junior Year</b>	MIME 3940-002 Co-Op Experience # 2	MIME 2600 Engineering Economics 3 cr. MIME 4050 Human Factors Engineering 3 cr. MIME 4080 Operations Research I 3 cr. MIME 4010 Engineering Statistics II 3 cr. MIME 4100 Manuf. System Simulation 3 cr. <b>Total 15 hours</b>	MIME 3940-003 Co-Op Experience # 3
<b>Junior Year</b>	MIME 3710 Work Design & Measurement 3 cr. MIME 4060 Manufacturing Engineering 3 cr. MIME 4070 Computer Aided Manuf. 3 cr. MIME 4090 Operations Research II 3 cr. EECS 2340 Elect Circuits for Non-Majors 3 cr. Hum./Soc. Sci. Elective 3 cr. <b>Total 18 hours</b>	MIME 3940-004 Co-Op Experience # 4	Technical Electives 6 cr. Hum/Soc. Sci. Elective 3 cr. Multicultural Electives 6 cr. <b>Total 15 hours</b>
<b>Senior Year</b>	MIME 3780 Engineering Management 3 cr. MIME 4020 Stat. Q. C. & Management 3 cr. MIME 4110 Prod. Planning & Inv. Control 3 cr. MIME 4200 Senior Design Projects 3 cr. MIME 4160 Facilities Planning 3 cr. Technical Electives 3 cr. <b>Total 18 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

**Degree Requirements**

Students should follow and complete the degree requirements as displayed in the Mechanical Engineering Program —Plan A or Plan B charts.

**Mechanical Engineering Program - Plan A**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. ENGL 1110 College Composition I 3 cr. MIME 1000 Orientation to ME and IE 3 cr. MIME 1100 Introduction to CAD 2 cr. <b>Total 16 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. MIME 1010 Professional Development 1 cr. MIME 1650 Materials Science & Engr. 3 cr. PHYS 2130 Engineering Physics I 5 cr. ENGL 1930 Tech. Writing for Engineers 3 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calculus 4 cr. PHYS 2140 Engineering Physics II 5 cr. CIVE 1150 Engineering Statics 3 cr. MIME 2650 Manufacturing Processes 3 cr. <b>Total 15 hours</b>	MIME 3940-001 Co-Op Experience # 1	MATH 3860 Differential Equations 3 cr. MATH 2890 Num. Methods & Linear Alg. 3 cr. CIVE 1160 Mechanics of Materials 3 cr. MIME 2000 Statistics & Meas. Lab 2 cr. MIME 2300 Engineering Dynamics 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 17 hours</b>
<b>Pre-Junior Year</b>	MIME 3940-002 Co-Op Experience # 2	MIME 2600 Engineering Economics 3 cr. MIME 3300 Design Anal - Mech. Sys. 3 cr. MIME 3310 Mechanical Design I 3 cr. MIME 3400 Thermodynamics I 3 cr. EECS 2340 Elect. Circuits for Non-Majors 3 cr. <b>Total 15 hours</b>	MIME 3940-003 Co-Op Experience # 3
<b>Junior Year</b>	EECS 3450 Elect. & Electronic Devices 3 cr. MIME 3320 Mechanical Design II 3 cr. MIME 3370 Vibration & Control 3 cr. MIME 3410 Thermodynamics II 3 cr. MIME 3430 Fluid Mechanics 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 18 hours</b>	MIME 3940-004 Co-Op Experience # 4	MIME 3440 Heat Transfer 3 cr. Hum./Soc. Sci./Multicultural Elective 6 cr. Technical Electives 6 cr. <b>Total 15 hours</b>
<b>Senior Year</b>	MIME 3390 Mechanics & Vibrations Lab 2 cr. MIME 3470 Thermal Science Lab 2 cr. MIME 4200 Senior Design Projects 3 cr. Technical Electives 6 cr. Hum./Soc. Sci./Multicultural Electives 3 cr. <b>Total 16 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

**Mechanical Engineering Program – Plan B**

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1850 Single Variable Calculus I 4 cr. CHEM 1230 General Chemistry I 4 cr. ENGL 1110 College Composition I 3 cr. MIME 1000 Orientation to ME and IE 3 cr. MIME 1100 Introduction to CAD 2 cr. <b>Total 16 hours</b>	MATH 1860 Single Variable Calculus II 4 cr. MIME 1010 Professional Development 1 cr. MIME 1650 Materials Science & Engr. 3 cr. PHYS 2130 Engineering Physics I 5 cr. ENGL 1930 Tech. Writing for Engineers 3 cr. <b>Total 16 hours</b>	
<b>Sophomore Year</b>	MATH 2850 Elem. Multivariable Calculus 4 cr. PHYS 2140 Engineering Physics II 5 cr. CIVE 1150 Engineering Statics 3 cr. MIME 2650 Manufacturing Processes 3 cr. <b>Total 15 hours</b>	MATH 3860 Differential Equations 3 cr. MATH 2890 Num. Methods & Linear Alg. 3 cr. CIVE 1160 Mechanics of Materials 3 cr. MIME 2000 Statistics & Meas. Lab 2 cr. MIME 2300 Engineering Dynamics 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 17 hours</b>	MIME 3940-001 Co-Op Experience # 1
<b>Pre-Junior Year</b>	MIME 2600 Engineering Economics 3 cr. MIME 3300 Design Anal - Mech. Sys. 3 cr. MIME 3310 Mechanical Design I 3 cr. MIME 3400 Thermodynamics I 3 cr. EECS 2340 Elect. Circuits for Non-Majors 3 cr. <b>Total 15 hours</b>	MIME 3940-002 Co-Op Experience # 2	MIME 3320 Mechanical Design II 3 cr. MIME 3370 Vibration & Control 3 cr. MIME 3410 Thermodynamics II 3 cr. MIME 3430 Fluid Mechanics 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 15 hours</b>
<b>Junior Year</b>	MIME 3940-003 Co-Op Experience # 3	EECS 3450 Elect. & Electronic Devices 3 cr. MIME 3440 Heat Transfer 3 cr. MIME 3390 Mechanics & Vibrations Lab 2 cr. MIME 3470 Thermal Science Lab 2 cr. MIME 4200 Senior Design Projects 3 cr. Technical Elective 3 cr. <b>Total 16 hours</b>	MIME 3940-004 Co-Op Experience # 4
<b>Senior Year</b>	Technical Electives 9 cr. Hum./Soc. Sci./Multicultural Electives 9 cr. <b>Total 18 hours</b>	Course work for deficiencies, business administration minor, graduate study or additional co-op experience.	

# Engineering Technology Programs

*Daniel J. Solarek, chair*

## Accreditation

The bachelor's program in computer science and engineering technology and both the associate's and bachelor's programs in construction engineering technology, mechanical engineering technology and electrical engineering technology are accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone 410.347.7700.

## Engineering Technology Degree Programs

The engineering technology department offers programs of study leading to the associate of applied science (A.A.S.) degree and the bachelor of science degree in engineering technology (B.S.E.T.). In mechanical engineering technology, construction engineering technology and electrical engineering technology, both the associate of applied science and the bachelor of science in engineering technology degrees are available. For computer science and engineering technology, only the bachelor of science in engineering technology degree is offered.

## Articulation Agreements

A total of 65-68 hours of course credit is required for an A.A.S., depending on the selected program of study. A total of 128 hours of course credit is required for the B.S.E.T. degree. Normally 64 hours of the baccalaureate program 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. In addition, articulation agreements with the following institutions will continue:

Central Ohio Technical College  
 Cincinnati State Technical and Community College  
 Columbus State Community College  
 Cuyahoga Community College  
 Edison Community College  
 Lakeland Community College  
 Lima Technical College  
 Lorain County Community College  
 Marion Technical College  
 Monroe County Community College  
 North Central Technical College  
 Northwest State Community College  
 Owens Community College  
 Stark State College of Technology  
 Terra Community College  
 Washtenaw Community College

## Degrees Offered

The TAC of ABET defines engineering technology as a distinct field of study related to the profession of engineering: "Engineering technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods combined with

technical skills in support of engineering activities: it lies in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer." The term "engineering technician" is applied to the graduates of associate's degree programs. Graduates of baccalaureate programs are called "engineering technologists." In industry, job titles with the term "engineer" are common for engineering technology graduates. Engineering technology education is based on sound foundations in applied sciences and mathematics. The curriculum emphasizes basic principles, applications and extensive laboratory experience.

The B.S.E.T. degree does not prepare its graduates for advanced study in traditional engineering programs. B.S.E.T. degree graduates can pursue the college's part-time master of science in engineering (after obtaining employment) or pursue graduate degrees in other colleges at The University of Toledo and elsewhere.

## Minor in Business Administration

Engineering technology 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 both ECON 1150 and 1200. The six business courses must include BUAD 2040 and should be chosen according to the rules in this catalog in the College of Business 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. 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 to become candidates for the business minor.

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 an adviser in both the College of Business Administration and the College of Engineering.

## Joint B.S.E.T./M.B.A. Program

The College of Business Administration, in conjunction with the College of Engineering, offers a program whereby a student may simultaneously earn both a B.S. in 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. It supports the mission to prepare corporate leaders for the future and to our knowledge is a one of a kind program in the state of Ohio. The program should be particularly attractive to students

who might want to start their own company or who simply want to develop an appreciation for how engineering and business complement each other.

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, but courses should be chosen carefully 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.

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 **before** fall semester of their senior year. Upon admission to the program by the Graduate School and the College of Business Administration, 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 degree 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 right courses, this may be accomplished with six undergraduate and 10 graduate level business courses.

For B.S.E.T. degree 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 with at least a 3.4 GPA and an LSAT score at or above the 50<sup>th</sup> 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.

## Admission Requirements

### Entering Freshmen

To be considered for admission to one of the bachelor of science in engineering technology programs, freshmen need at least a 2.0 cumulative high school GPA **and** a minimum ACT composite score of 21 (or SAT combined score of 1000). Students who do not meet these requirements may be considered for admission to an associate of applied science program in the engineering technology department or to another University program.

## Transfer Students

### (Admission with Advanced Standing)

Students transferring into the College of Engineering from within the University or from other colleges and universities must have obtained a minimum cumulative GPA of at least 2.0. Transfer to upper level engineering technology programs requires a 2.0 cumulative GPA.

Students transferring from other institutions must earn at least 32 hours of undergraduate credit in residence at The University of Toledo. At least 14 hours of these must be in the major area. The remainder are to be in engineering science, engineering design and other hours as necessary to meet 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. Bachelor of science in engineering technology students must earn at least 32 hours at The University of Toledo, not including deficiencies. Associate of applied science students must earn at least 17 hours at The University of Toledo; at least 8 hours must be in the major.

## Cooperative (Co-op) Education Program

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

## Professional Registration

### B.S.E.T. Degree Students

Registration by the state of Ohio as a Professional Engineer is important for professional practice and requires eight years of experience as an engineering technologist after graduation. The first step, however, is applying for and passing the Fundamentals of Engineering (FE) Examination formerly known as the Engineer-in-Training (EIT) exam. Engineering technology students may apply to take the exam prior to graduation, but must have graduated at the time the exam is taken. The exam is generally given in April and October of each year. Application deadlines are several months earlier, however. The test should be taken shortly after graduation.

The FE Examination is given on-campus during a Saturday in April. Applications should be filed with the board in Columbus at least 75 days prior to the April examination date and at least 60 days prior to the October examination date. Further information is available in the Office of the Associate Dean of Undergraduate Studies, or from the Secretary of the Board of Registration for Professional Engineers and Surveyors, 77 S. High St., Columbus, OH 43266-0314.

## Department of Engineering Technology

*Daniel J. Solarek, chair*

Graduates of the B.S.E.T. program are eligible to sit for the FE examination in most states as the first step toward registration as a Professional Engineer (PE). Students transferring into this program from other colleges and universities with deficiencies will be required to complete course prerequisites before enrolling in required upper-division courses.

### Computer Science and Engineering Technology

Computer science and engineering technology prepares students for positions as engineering technologists in engineering support in the electronics industry, manufacturing, testing, sales and service, and design support of equipment and systems used in communication, instrumentation, computers, automation and power.

It is the goal of the computer science and engineering technology program to provide students with the opportunity to:

- acquire skill in the use of mathematics and basic science;
- acquire skill in the use of written and oral communications;
- acquire skill in some of the analytical and laboratory methods of electrical engineering technology;
- acquire skill in the use of modern computer technology;
- learn about some of the social contexts in which technology is applied; and
- gain the skills necessary to function in a professional environment.

### Construction Engineering Technology

Construction engineering technology prepares students for positions as engineering technicians or technologists in engineering support in the construction industry, shelter, and transportation infrastructure.

It is the mission of the construction engineering technology (C.E.T.) program to prepare students to obtain career positions as professionals in the construction and building industries where they will ensure quality in all phases of construction projects including

- coordination of the design process;
- monitoring of the quality control of materials and workmanship; and
- management of costs and progression of construction.

In order to achieve this mission, the goals of the program are to:

- provide students with a core of basic engineering theory and practice through realistic training and education that emphasizes the current practices used in the construction industry;
- educate students about the manner in which the earth's natural resources are used as components in the construction industry;
- educate students to gain knowledge of construction requirements and management skills in order to have the ability to assist in the supervision and management of projects in the industry; and
- fulfill the changing needs of local business and industry for qualified employees in the areas of construction technical sales,

materials testing, surveying, construction contracting, and building and infrastructure design.

### Electrical Engineering Technology

Electrical engineering technology prepares students for positions as engineering technicians or technologists in engineering support in the electronics industry, manufacturing, testing, sales and service, and design support of equipment and systems used in communication, instrumentation, computers, automation and power.

The goals of the electrical engineering technology program are to provide students with the opportunity to:

- acquire skill in the use of mathematics and basic science;
- acquire skill in the use of written and oral communications;
- acquire skill in the analytical and laboratory methods of electrical engineering technology;
- learn about some of the social contexts in which technology is applied; and
- gain the skills necessary to function in a professional environment.

### Mechanical Engineering Technology

Mechanical engineering technology prepares students for positions as engineering technicians or technologists in engineering support in the manufacturing industry, testing and design support functions.

The goals of the mechanical engineering technology program are to provide students with the opportunity to:

- acquire a mastery of both the general and specific MET knowledge and skills and the ability to use these in mechanical engineering applications and problem solving;
- develop the ability to research engineering problems and apply the results to solutions;
- gain skills in working in teams;
- develop skills for effective communication;
- formulate and adopt a socially responsible set of professional, ethical, and social values; and
- participate in an environment that demonstrates the value of quality, continuous improvement, and lifelong learning

The following, as well as other upper-division courses in the College of Engineering that are closely related to the discipline, are approved as technical electives:

EET	4650	Field Programmable Logic Devices .....	4
EET	4750	Computer Networks & Data Communications .....	3
EEES	3250	Engineering Geology .....	3
MET	4500	Computer-Aided Design (CAD) .....	3
MET	4600	Engineering Safety .....	3
MET	4700	Quality Control .....	3

**Degree Requirements**

Students should follow and complete the degree requirements in the Computer Science and Engineering Technology Full-time, Part-time, or Co-op charts.

**Computer Science and Engineering Technology (Full-time)**

	<b>Fall Semester</b>	<b>Spring Semester</b>
<b>Freshman Year</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. ENGL 1110 College Composition I 3 cr. EET 1010 Resistive Circuits 4 cr. <b>Total 15 hours</b>	CSET 1200 GUI Programming 3 cr. EET 1020 Reactive Circuits 4 cr. EET 2010 Electronic Principles 4 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. Hum./ Soc. Sci./Multicultural Elective 3 cr. <b>Total 17 hours</b>
<b>Sophomore Year</b>	PHYS 2010 Tech. Physics Mechanics 4 cr. MATH 2450 Technical Calculus I 4 cr. CSET 2100 Small Computers Systems 4 cr. EET 2210 Digital Logic Fundamentals 4 cr. <b>Total 16 hours</b>	PHYS 2020 Tech. Physics 4 cr. MATH 2460 Technical Calculus II 3 cr. CSET 2200 PC & Industrial Networks 4 cr. EET 2230 Assembly Language Prog. 4 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 18 hours</b>
<b>Junior Year</b>	ENGT 3010 Applied Statistics & DOE 4 cr. MATH 2890 Num. Methods & Linear Alg. 3 cr. EET 3150 UNIX, C & the Internet 4 cr. Communication Elective 3 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 17 hours</b>	CSET 4750 Comp. Net. & Data Comm 4 cr. EET 3350 Digital Systems Design 4 cr. CSET 3200 Client/Server Computing 3 cr. Professional Development Elective 4 cr. <b>Total 15 hours</b>
<b>Senior Year</b>	CSET 4650 Field Prog. Logic Dev. 4 cr. EET 4250 Microcomputer Architecture 4 cr. CSET 4100 CGI Prog With Perl & Java 3 cr. Hum./Soc. Sci./Multicultural Electives 3 cr. <b>Total 14 hours</b>	ENGT 4050 Senior Tech. Capstone 3 cr. CSET 4200 VLSI Technology 4 cr. CSET 4250 Applied Prog. Languages 3 cr. Professional Development Elective 3 cr. Hum./Soc. Sci./Multicultural 3 cr. <b>Total 16 hours</b>

**Computer Science and Engineering Technology (Part-time)**

	<b>Fall Semester</b>	<b>Spring Semester</b>	<b>Summer Semester</b>
<b>Year 1</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. <b>Total 8 hours</b>	CSET 1200 GUI Programming 3 cr. EET 1010 Resistive Circuits 4 cr. <b>Total 7 hours</b>	ENGL 1110 College Composition I 3 cr. EET 1020 Reactive Circuits 4 cr. <b>Total 7 hours</b>
<b>Year 2</b>	MATH 2450 Technical Calculus I 4 cr. EET 2010 Electronic Principles 4 cr. <b>Total 8 hours</b>	PHYS 2010 Tech. Physics Mechanics 4 cr. EET 2210 Digital Logic Fundamentals 4 cr. <b>Total 8 hours</b>	CSET 2100 Small Computers Systems 4 cr. Hum./ Soc. Sci./Multicultural Elective 3 cr. <b>Total 7 hours</b>
<b>Year 3</b>	MATH 2460 Technical Calculus II 3 cr. CSET 2200 PC & Industrial Networks 4 cr. <b>Total 7 hours</b>	ENGL 2950 Sci. & Tech. Report Writing 3 cr. PHYS 2020 Technical Physics 4 cr. <b>Total 7 hours</b>	EET 2230 Assembly Language Prog. 4 cr. Hum./Soc. Sci./Multicultural Elective 3 cr. <b>Total 7 hours</b>
<b>Year 4</b>	MATH 2890 Num. Methods & Linear Alg. 3 cr. EET 3150 UNIX, C & the Internet 4 cr. <b>Total 7 hours</b>	EET 3350 Digital Systems Design 4 cr. Communication Elective 3 cr. <b>Total 7 hours</b>	ENGT 3010 Appl. Statistics & DOE 4 cr. CSET 4750 Comp. Net. & Data Comm. 4 cr. <b>Total 8 hours</b>
<b>Year 5</b>	Professional Development Elective 4 cr. Hum./Soc. Sci./Multicultural 3 cr. <b>Total 7 hours</b>	CSET 4650 Field Prog. Logic Devices 4 cr. CSET 4100 CGI Prog. With Perl & Java 3 cr. <b>Total 7 hours</b>	CSET 4200 VLSI Technology 4 cr. Hum./Soc. Sci./Multicultural 3 cr. <b>Total 7 hours</b>
<b>Year 6</b>	CSET 4250 Applied Prog. Languages 3 cr. CSET 3200 Client-Server Computing 3 cr. <b>Total 6 hours</b>	EET 4250 Microcomputer Architecture 4 cr. ENGT 4050 Senior Tech. Capstone 3 cr. <b>Total 7 hours</b>	Professional Development Elective 3 cr. Hum./Soc. Sci./Multicultural 3 cr. <b>Total 6 hours</b>



## Degree Requirements

Students should follow and complete the degree requirements in the Computer Science and Engineering Technology Full-time, Part-time, or Co-op charts.

### Computer Science and Engineering Technology (Co-op)

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. ENGL 1110 College Composition I 3 cr. EET 1010 Resistive Circuits 4 cr. <b>Total 15 hours</b>	CSET 1200 GUI Programming 3 cr. EET 1020 Reactive Circuits 4 cr. EET 2010 Electronic Principles 4 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. Social Science Elective 3 cr. <b>Total 17 hours</b>	OPEN
<b>Sophomore Year</b>	PHYS 2010 Tech. Physics Mechanics 4 cr. MATH 2450 Technical Calculus I 4 cr. CSET 2100 Small Computers Systems 4 cr. EET 2210 Digital Logic Fundamentals 4 cr. ENGT 2000 Professional Development 1 cr. <b>Total 17 hours</b>	PHYS 2020 Tech. Physics 4 cr. MATH 2460 Technical Calculus II 3 cr. CSET 2200 PC & Industrial Networks 4 cr. EET 2230 Assembly Language Prog. 4 cr. Humanities Elective 3 cr. <b>Total 18 hours</b>	ENGT 3940 Co-op #1
<b>Pre-Junior Year</b>	ENGT 3010 Applied Statistics & DOE 4 cr. MATH 2890 Num. Methods & Linear Alg. 3 cr. EET 3150 UNIX, C & the Internet 4 cr. Communication Elective 3 cr. Multicultural Elective (U.S.) 3 cr. <b>Total 17 hours</b>	ENGT 3940 Co-op #2	CSET 4200 VLSI Technology 4 cr. CSET 4750 Comp. Net. & Data Comm 4 cr. Professional Development Elective 4 cr. Social Science Elective 3 cr. <b>Total 15 hours</b>
<b>Junior Year</b>	ENGT 3940 Co-op #3	EET 3350 Digital Systems Design 4 cr. CSET 4650 Field Prog. Logic Dev. 4 cr. CSET 4100 CGI Prog With Perl & Java 3 cr. Professional Development Elective 3 cr. <b>Total 14 hours</b>	ENGT 3940 Co-op #4
<b>Senior Year</b>	ENGT 4050 Senior Tech. Capstone 3 cr. EET 4250 Microcomputer Architecture 4 cr. CSET 3200 Client/Server Computing 3 cr. CSET 4250 Applied Prog. Languages 3 cr. Multicultural Elective (non-U.S.) 3 cr. <b>Total 16 hours</b>		

**Degree Requirements**

Students should follow and complete the degree requirements in the Construction Engineering Technology Full-time, Part-time, or Co-op charts.

**Construction Engineering Technology (Full-time)**

	Fall Semester	Spring Semester
<b>Freshman Year</b>	MATH 1320 College Algebra 3 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. ENGL 1110 College Composition I 3 cr. CET 1100 Architectural Graphics 3 cr. CET 1150 Construction Mats & Codes 3 cr. <b>Total 16 hours</b>	MATH 1330 Trigonometry 3 cr. PHYS 2010 Technical Physics: Mechanics 4 cr. CET 1210 Surveying 3 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. ARCT 2250 Building Systems 3 cr. <b>Total 16 hours</b>
<b>Sophomore Year</b>	PHYS 2020 Technical Physics 4 cr. MATH 2450 Technical Calculus I 4 cr. CET 1200 Engineering Mechanics 4 cr. CET 2110 Materials Testing 3 cr. ECON 1150 Prin. of Macroeconomics 3 cr. <b>Total 18 hours</b>	CET 2220 Soil Mechanics 3 cr. ARCT 1260 Construction Estimating 3 cr. CET 2250 Structural Design 4 cr. CET 2030 Construction Graphics 3 cr. Multicultural Elective (U.S.) 3 cr. <b>Total 16 hours</b> Note: Completion of the first two years of study fulfills the minimum requirements for the associate degree in CET.
<b>Junior Year</b>	CET 3210 Surveying Applications 3 cr. MATH 2460 Technical Calculus II 3 cr. ECON 1200 Principles of Microeconomics 3 cr. Communication Elective 3 cr. EEES 3250 Engineering Geology 3 cr. <b>Total 15 hours</b>	CET 2210 Hydrology and Hydraulics 3 cr. CET 3120 Adv. Construction Materials 3 cr. MATH 2600 Intro to Statistics 3 cr. BUAD 2040 Financial Accounting 3 cr. ARCT 2160 Contracts and Specifications 3 cr. <b>Total 15 hours</b>
<b>Senior Year</b>	CET 4250 Advanced Structural Design 4 cr. CET 4460 Construction Mgmt & Sched. 3 cr. ENGT 3600 Engineering Economics 3 cr. BUAD 3030 Managerial and Behavioral Processes in Organizations 3 cr. Multicultural Elective (non-western) 3 cr. <b>Total 16 hours</b>	ENGT 4050 Senior Tech. Capstone 3 cr. CET 4350 Soils, Foundation, & Earth Structures 4 cr. Social Science Elective 3 cr. Humanities Elective 3 cr. BUAD 3470 Legal & Ethical Environment Of Business 3 cr. <b>Total 16 hours</b>

**Construction Engineering Technology (Part-time)**

	Fall Semester	Spring Semester	Summer Semester
<b>Year 1</b>	MATH 1320 College Algebra 3 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. <b>Total 7 hours</b>	CET 1100 Architectural Graphics 3 cr. CET 1150 Construction Mats & Codes 3 cr. <b>Total 6 hours</b>	ENGL 1110 College Composition I 3 cr. MATH 1330 Trigonometry 3 cr. <b>Total 6 hours</b>
<b>Year 2</b>	ENGL 2950 Sci. & Tech. Report Writing 3 cr. PHYS 2010 Technical Physics: Mechanics 4 cr. <b>Total 7 hours</b>	PHYS 2020 Technical Physics 4 cr. CET 2030 Construction Graphics 3 cr. ARCT 2250 Building Systems 3 cr. <b>Total 10 hours</b>	ECON 1150 Principles of Macroeconomics 3 cr. CET 1210 Surveying 3 cr. <b>Total 6 hours</b>
<b>Year 3</b>	CET 1200 Engineering Mechanics 4 cr. CET 2110 Materials Testing 3 cr. <b>Total 7 hours</b>	CET 2250 Structural Design 4 cr. ARCT 1260 Construction Estimating 3 cr. MATH 2450 Technical Calculus I 4 cr. <b>Total 11 hours</b>	ECON 1200 Prin. of Microeconomics 3 cr. Hum/SS/Multicultural Elective 3 cr. <b>Total 6 hours</b>
<b>Year 4</b>	EEES 3250 Engineering Geology 3 cr. CET 3210 Surveying Applications 3 cr. <b>Total 6 hours</b>	CET 2250 Soil Mechanics 3 cr. ARCT 2160 Contracts & Specifications 3 cr. Hum/SS/Multicultural Elective 3 cr. <b>Total 9 hours</b>	CET 2210 Hydrology and Hydraulics 3 cr. BUAD 2040 Financial Accounting Info. 3 cr. <b>Total 6 hours</b>
<b>Year 5</b>	CET 2980 Engineering Economics 3 cr. MATH 2600 Intro to Statistics 3 cr. CET 4250 Adv. Structural Design 4 cr. <b>Total 10 hours</b>	CET 3120 Adv. Construction Materials 3 cr. MATH 2460 Technical Calculus II 3 cr. <b>Total 6 hours</b>	Communication Elective 3 cr. BUAD 3030 Management & Behavior 3 cr. <b>Total 6 hours</b>
<b>Year 6</b>	CET 4460 Construction Mgmt & Sched. 3 cr. Hum/SS/Multicultural Elective 3 cr. <b>Total 6 hours</b>	CET 4350 Soils, Foundation, & Earth Structures 4 cr. ENGT 4050 Senior Tech. Capstone 3 cr. <b>Total 7 hours</b>	BUAD 3470 Legal & Ethical Environmental of Business 3 cr. Hum./Soc. Sci./Multicultural Electives 3 cr. <b>Total 6 hours</b>

**Degree Requirements**

Students should follow and complete the degree requirements in the Construction Engineering Technology Full-time, Part-time, or Co-op charts.

**Construction Engineering Technology (Co-op)**

	<b>Fall Semester</b>	<b>Spring Semester</b>	<b>Summer Semester</b>
<b>Freshman Year</b>	MATH 1320 College Algebra 3 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. ENGL 1110 College Composition I 3 cr. CET 1100 Arch Graphics 3 cr. CET 1150 Const. Mat'ls & Codes 3 cr. <b>Total 16 hours</b>	MATH 1330 Trigonometry 3 cr. PHYS 2010 Tech. Physics Mechanics 4 cr. CET 1210 Surveying 3 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. ARCT 2250 Building Systems 3 cr. <b>Total 16 hours</b>	OPEN
<b>Sophomore Year</b>	PHYS 2020 Tech. Physics 4 cr. MATH 2450 Technical Calculus I 4 cr. CET 1200 Engineering Mechanics 4 cr. CET 2110 Materials Testing 3 cr. ECON 1150 Macroeconomics 3 cr. ENGT 2000 Professional Development 1 cr. <b>Total 19 hours</b>	CET 2220 Soil Mechanics 3 cr. ARCT 1260 Construction Estimating 3 cr. CET 2250 Structural Design 4 cr. CET 2030 Construction Graphics 3 cr. MC/Hum/SS Elective 3 cr. <b>Total 16 hours</b>	ENGT 3940 Co-op #1
<b>Pre-Junior Year</b>	MATH 2460 Technical Calculus II 3 cr. CET 3210 Survey Applications 3 cr. ECON 1200 Microeconomics 3 cr. EEEE 3250 Engineering Geology 3 cr. Communications Elective 3 cr. MC/Hum/SS Elective 3 cr. <b>Total 18 hours</b>	ENGT 3940 Co-op #2	BUAD 2040 Financial Accounting 3 cr. MATH 2600/ENGT 3010 Statistics 3 cr. BUAD 3030 Management & Behavior 3 cr. MC/Hum/SS Elective 3 cr. CET 2210 Hydrology & Hydraulics 3 cr. <b>Total 15 hours</b>
<b>Junior Year</b>	ENGT 3940 Co-op #3	CET 3120 Adv. Construction Materials 3 cr. CET 4350 Soils, Found. & Earth Stru. 4 cr. BUAD 3470 Legal & Ethical Env. 3 cr. ARCT 2160 Contracts & Specifications 3 cr. MC/Hum/SS Elective 3 cr. <b>Total 16 hours</b>	ENGT 3940 Co-op #4
<b>Senior Year</b>	ENGT 3600 Engineering Economy 3 cr. ENGT 4050 Senior Tech. Capstone 3 cr. CET 4250 Adv. Structural Design 4 cr. CET 4460 Const. Mgmt & Scheduling 3 cr. MC/Hum/SS Elective 3 cr. <b>Total 16 hours</b>		

**Degree Requirements**

Students should follow and complete the degree requirements in the Electrical Engineering Technology Full-time, Part-time, or Co-op charts.

**Electrical Engineering Technology (Full-time)**

	Fall Semester	Spring Semester
<b>Freshman Year</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGL 1110 College Composition I 3 cr. EET 1010 Resistive Circuits 4 cr. EET 1410 Electrical Drafting 3 cr. <b>Total 15 hours</b>	ENGT 1050 Computers for Eng. Tech. 3 cr. EET 1020 Reactive Circuits 4 cr. EET 2010 Electronic Principles 4 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. Social Science Elective 3 cr. <b>Total 17 hours</b>
<b>Sophomore Year</b>	PHYS 2010 Technical Physics: Mechanics 4 cr. MATH 2450 Technical Calculus I 4 cr. EET 2020 Electronic Device Applications 4 cr. EET 2210 Digital Logic Fundamentals 4 cr. <b>Total 16 hours</b>	MATH 2460 Technical Calculus II 3 cr. PHYS 2020 Technical Physics 4 cr. EET 2230 Assembly Language Prog. 4 cr. EET 2410 Programmable Controller Fund. 4 cr. Humanities Elective 3 cr. <b>Note:</b> Completion of the first two years of study fulfills the minimum requirements for the associate degree in EET <b>Total 18 hours</b>
<b>Junior Year</b>	ENGT 3010 Applied Statistics and Design of Experiments 4 cr. ENGT 3020 Applied Engineering Math 3 cr. EET 3150 UNIX, C, and Internet 4 cr. Communication Elective 3 cr. Multicultural Elective (U.S. based) 3 cr. <b>Total 17 hours</b>	EET 3250 Network Analysis 4 cr. EET 3350 Digital Systems Design 4 cr. Professional Development Elective 4 cr. Social Science Elective 3 cr. <b>Total 15 hours</b>
<b>Senior Year</b>	EET 4150 Analog Systems Design 4 cr. EET 4250 Microcomputer Architecture 4 cr. EET 4350 Electric Power Systems 4 cr. Multicultural Elective (non-western) 3 cr. <b>Total 15 hours</b>	ENGT 4050 Senior Tech. Capstone 3 cr. EET 4450 Automatic Control Systems 4 cr. EET 4550 Programmable Controller Applications 4 cr. Professional Development Elective 4 cr. <b>Total 15 hours</b>

**Electrical Engineering Technology (Part-time)**

	Fall Semester	Spring Semester	Summer Semester
<b>Year 1</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. EET 1410 Electrical Drafting 3 cr. <b>Total 8 hours</b>	ENGT 1050 Computers for Eng. Tech 3 cr. EET 1010 Resistive Circuits 4 cr. <b>Total 7 hours</b>	ENGL 1110 College Composition I 3 cr. EET 1020 Reactive Circuits 4 cr. <b>Total 7 hours</b>
<b>Year 2</b>	MATH 2450 Technical Calculus I 4 cr. EET 2010 Electronic Principles 4 cr. <b>Total 8 hours</b>	PHYS 2010 Technical Physics: Mechanics 4 cr. EET 2210 Digital Logic Fundamentals 4 cr. <b>Total 8 hours</b>	EET 2020 Electronic Device Applications 4 cr. Social Science Elective 3 cr. <b>Total 7 hours</b>
<b>Year 3</b>	MATH 2460 Technical Calculus II 3 cr. EET 2410 Programmable Controller Fund. 4 cr. <b>Total 7 hours</b>	PHYS 2020 Technical Physics 4 cr. ENGL 2950 Science & Tech. Rpt. Wtg 3 cr. <b>Total 7 hours</b>	EET 2230 Assembly Language Prog. 4 cr. Humanities Elective 3 cr. <b>Total 7 hours</b>
<b>Year 4</b>	ENGT 3020 Applied Eng. Mathematics 3 cr. EET 3150 UNIX, C, and Internet 4 cr. <b>Total 7 hours</b>	EET 3350 Digital Systems Design 4 cr. Communication Elective 3 cr. <b>Total 7 hours</b>	ENGT 3010 Appl. Stat. & DOE 4 cr. EET 3250 Network Analysis 4 cr. <b>Total 8 hours</b>
<b>Year 5</b>	Multicultural Elective 3 cr. Professional Development Elective 4 cr. <b>Total 7 hours</b>	EET 4150 Analog Systems Design 4 cr. EET 4350 Electric Power Systems 4 cr. <b>Total 8 hours</b>	EET 4550 Programm. Cont. Appl. 4 cr. Social Science Elective 3 cr. <b>Total 7 hours</b>
<b>Year 6</b>	EET 4450 Automatic Control Systems 4 cr. Humanities/Multicultural Double Dip. 3 cr. <b>Total 7 hours</b>	EET 4250 Microcomputer Architecture 4 cr. ENGT 4050 Senior Tech. Capstone 3 cr. <b>Total 7 hours</b>	Professional Development Elective 4 cr. <b>Total 4 hours</b>

### Degree Requirements

Students should follow and complete the degree requirements in the Electrical Engineering Technology Full-time, Part-time, or Co-op charts.

### Electrical Engineering Technology (Co-op)

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. to Engineering Tech. 1 cr. ENGL 1110 College Composition I 3 cr. EET 1010 Resistive Circuits 4 cr. EET 1410 Electrical Drafting 3 cr. <b>Total 15 hours</b>	ENGT 1050 Computers for Eng. Tech. 3 cr. EET 1020 Reactive Circuits 4 cr. EET 2010 Electronic Principles 4 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. Social Science Elective 3 cr. <b>Total 17 hours</b>	OPEN
<b>Sophomore Year</b>	PHYS 2010 Tech. Physics: Mechanics 4 cr. MATH 2450 Technical Calculus I 4 cr. EET 2020 Electronic Device Applications 4 cr. EET 2210 Digital Logic Fundamentals 4 cr. ENGT 2000 Prof. Develop. (COOP) 1 cr. <b>Total 17 hours</b>	MATH 2460 Technical Calculus II 3 cr. PHYS 2020 Technical Physics 4 cr. EET 2230 Assembly Language Prog. 4 cr. EET 2410 Programm. Controllor Fund. 4 cr. Humanities Elective 3 cr. <b>Total 18 hours</b>	ENGT 3940 Co-op #1
<b>Pre-Junior Year</b>	ENGT 3010 Appl. Stat. & DOE 4 cr. ENGT 3020 Applied Engineering Math 3 cr. EET 3150 UNIX, C, and Internet 4 cr. Communication Elective 3 cr. Multicultural Elective (U.S. based) 3 cr. <b>Total 17 hours</b>	ENGT 3940 Co-op #2	EET 3250 Network Analysis 4 cr. EET 4550 PLC Applications 4 cr. Professional Development Elective 4 cr. Social Science Elective 3 cr. <b>Total 15 hours</b>
<b>Junior Year</b>	ENGT 3940 Co-op #3	EET 3350 Digital Systems Design 4 cr. EET 4150 Analog Systems Design 4 cr. EET 4350 Electric Power Systems 4 cr. Multicultural Elective (non-western) 3 cr. <b>Total 15 hours</b>	ENGT 3940 Co-op #4
<b>Senior Year</b>	ENGT 4050 Senior Tech. Capstone 3 cr. EET 4450 Automatic Control Systems 4 cr. EET 4250 Microcomputer Architecture 4 cr. Professional Development Elective 4 cr. <b>Total 15 hours</b>		

**Degree Requirements**

Students should follow and complete the degree requirements in the Mechanical Engineering Technology Full-time or Part-time charts.

**Mechanical Engineering Technology (Full-time)**

	Fall Semester	Spring Semester
<b>Freshman Year</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. MET 1020 Technical Drawing 2 cr. MET 1110 Metal Machining & Processes 4 cr. MET 1120 Metal Mach. & Proc. Lab 1 cr. <b>Total 15 hours</b>	ENGL 1110 College Composition I 3 cr. MET 1250 CADD 4 cr. PHYS 2010 Technical Physics: Mechanics 4 cr. Humanities Elective 3 cr. <b>Total 14 hours</b>
<b>Sophomore Year</b>	PHYS 2020 Technical Physics 4 cr. MATH 2450 Technical Calculus I 4 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. MET 2100 Eng. Mechanics: Statics 3 cr. Social Science Elective 3 cr. <b>Total 17 hours</b>	MATH 2460 Technical Calculus II 3 cr. MET 2210 Technical Thermodynamics 4 cr. MET 2120 Eng. Mech: Strength of Mat'ls 4 cr. MET 2350 Adv CADD or MET 2150 NC Appl 4 cr. MET 2050 Fluid & Hydraulic Mechanics 4 cr. Note: Completion of the first two years of study fulfills the minimum requirements for the associate degree in MET <b>Total 19 hours</b>
<b>Junior Year</b>	ENGT 3010 Applied Statistics and Design of Experiments 4 cr. ENGT 3020 Applied Engineering Math 3 cr. MET 3400 Dynamics 3 cr. COMM 3810 Group Communication 3 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 General Chemistry I Lab 1 cr. <b>Total 18 hours</b>	MET 3100 Applied Thermodynamics 4 cr. MET 3200 Mechanical Design I 3 cr. MET 3300 Appl Circuit Anal & Electron. 4 cr. ENGT 3040 Applied Materials Science 4 cr. <b>Total 15 hours</b>
<b>Senior Year</b>	MET 4100 Applied Fluid Mechanics 4 cr. MET 4200 Mechanical Design II 3 cr. MET 4300 Applied Control Systems 3 cr. Humanities/Social Science/Multicultural 6 cr. <b>Total 16 hours</b>	ENGT 4050 Senior Tech. Capstone Technical Elective 3 cr. Humanities/Social Science Elective 3 cr. Professional Development Electives 5 cr. <b>Total 14 hours</b>

**Mechanical Engineering Technology (Part-time)**

	Fall Semester	Spring Semester	Summer Semester
<b>Year 1</b>	ENGT 1000 Intro. To Engineering Tech. 1 cr. MET 1020 Technical Drawing 2 cr. MET 1110 Metal Machining & Processes 4 cr. MET 1120 Metal Mach. & Proc. Lab 1 cr. <b>Total 8 hours</b>	ENGT 1050 Computers for Eng. Tech 3 cr. MATH 1340 College Algebra & Trig. 4 cr. <b>Total 7 hours</b>	ENGL 1110 College Composition I 3 cr. PHYS 2010 Technical Physics: Mechanics 4 cr. <b>Total 7 hours</b>
<b>Year 2</b>	MATH 2450 Technical Calculus I 4 cr. MET 1250 CADD 4 cr. <b>Total 8 hours</b>	PHYS 2020 Technical Physics 4 cr. MET 2100 Statics for Technology 3 cr. <b>Total 7 hours</b>	MET 2120 Strength of Materials for Tech 4 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. <b>Total 7 hours</b>
<b>Year 3</b>	MATH 2460 Technical Calculus II 3 cr. MET 1250 Fluid & Hydraulic Mechanics 4 cr. <b>Total 7 hours</b>	MET 2210 Technical Thermodynamics 4 cr. Technical Electives (see advisor) 4 cr. <b>Total 8 hours</b>	Social Services Elective 3 cr. Humanities Elective 3 cr. <b>Total 6 hours</b>
<b>Year 4</b>	ENGT 3020 Applied Eng. Mathematics 3 cr. MET 3200 Mechanical Design I 3 cr. <b>Total 6 hours</b>	MET 3100 Applied Thermodynamics 4 cr. MET 3400 Applied Dynamics 3 cr. <b>Total 7 hours</b>	ENGT 3010 Appl Stat & DOE 4 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 General Chemistry I Lab 1 cr. <b>Total 9 hours</b>
<b>Year 5</b>	ENGT 3040 Applied Materials Science 4 cr. MET 3300 Applied Circuit Analysis and Electronics 4 cr. <b>Total 8 hours</b>	MET 4100 Applied Fluid Mechanics 4 cr. MET 4200 Mechanical Design II 3 cr. <b>Total 7 hours</b>	COMM 3810 Group Communication 3 cr. Multicultural Elective 3 cr. <b>Total 6 hours</b>
<b>Year 6</b>	MET 4300 Applied Control Systems for MET 3 cr. Social Science Elective 3 cr. <b>Total 6 hours</b>	ENGT 4050 Senior Tech. Capstone Technical Elective (see advisor) 3 cr. Professional Development Elective 2 cr. <b>Total 8 hours</b>	Professional Development Elective 3 cr. Multicultural Elective 3 cr. <b>Total 6 hours</b>

## Degree Requirements

Students should follow and complete the degree requirements in the Mechanical Engineering Technology Full-time or Part-time charts.

### Mechanical Engineering Technology (Co-op)

	Fall Semester	Spring Semester	Summer Semester
<b>Freshman Year</b>	MATH 1340 College Algebra & Trig. 4 cr. ENGT 1000 Intro. To Engineering Tech. 1 cr. ENGT 1050 Computers for Eng. Tech. 3 cr. MET 1020 Technical Drawing 2 cr. MET 1110 Metal Mach. & Proc. 4 cr. MET 1120 Metal Mach. & Proc. Lab 1 cr. <b>Total 15 hours</b>	ENGL 1110 College Composition I 3 cr. PHYS 2010 Tech. Physics Mechanics 4 cr. MET 1250 CADD 4 cr. Humanities Elective 3 cr. <b>Total 14 hours</b>	OPEN
<b>Sophomore Year</b>	PHYS 2020 Tech. Physics 4 cr. MATH 2450 Technical Calculus I 4 cr. ENGL 2950 Sci. & Tech. Report Writing 3 cr. MET 2100 Engineering Mech. Statics 3 cr. ENGT 2000 Professional Development 1 cr. Social Science Elective 3 cr. <b>Total 18 hours</b>	MATH 2460 Technical Calculus II 3 cr. MET 2050 Fluid & Hydro Mech 4 cr. MET 2120 Strength of Materials 4 cr. MET 2210 Tech Thermo 4 cr. MET 2150 NC or MET 2350 Adv CADD 4 cr. <b>Total 19 hours</b>	ENGT 3940 Co-op #1
<b>Pre-Junior Year</b>	MET 3400 Dynamics 3 cr. ENGT 3010 Applied Statistics & DOE 4 cr. ENGT 3020 Applied Engineering Math 3 cr. CHEM 1230 General Chemistry I 4 cr. CHEM 1280 General Chemistry I Lab 1 cr. COMM 3810 Sm Grp Communications 3 cr. <b>Total 18 hours</b>	ENGT 3940 Co-op #2	ENGT 3040 Applied Mat'ls Science 4 cr. MET 3100 Applied Thermodynamics 4 cr. Technical Elective 3 cr. Social Science Elective 3 cr. <b>Total 14 hours</b>
<b>Junior Year</b>	ENGT 3940 Co-op #3	MET 3200 Mechanical Design I 3 cr. MET 3300 Applied Circuit Anal & Elect 4 cr. MET 4100 Applied Fluid Mechanics 4 cr. Multicultural Elective (U.S.) 3 cr. Professional Development Elective 2 cr. <b>Total 16 hours</b>	ENGT 3940 Co-op #4
<b>Senior Year</b>	MET 4200 Mechanical Design II 3 cr. ENGT 4050 Senior Tech. Capstone 3 cr. MET 4300 Applied Control Systems 3 cr. Professional Development Elective 3 cr. Multicultural Elective (non-U.S.) 3 cr. <b>Total 16 hours</b>		

# College of Engineering Faculty

## Department of Bioengineering

**Ozan Akkus**, 2002, assistant professor

B.S.M.E., M.S.E.S., Middle East Technical University; Ph.D., Case Western Reserve University

**Brent D. Cameron**, 2000, professor

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

**Ronald L. Fournier**, 1985, professor

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

**Vijay K. Goel**, 2000, professor and chair

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

**Jeffrey D. Johnson**, 1996, assistant professor

B.S.E.E., Ph.D., University of Cincinnati

**Vikram J. Kapoor**, 1994, professor and director of Nanotechnology Research Center

M.S., Ph.D., Lehigh University

**Frank J. Kollarits**, 1980, associate professor

B.S., M.S., John Carroll University; Ph.D., The Ohio State University

**Jian-yu Lu**, 1997, professor

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

**W. E. Michael Mikhail**, 1997, McMaster/Gardner Research Professor of Orthopaedic Biomedical Engineering

M.B., Ch.B., M.D., Cairo University School of Medicine

**Scott C. Molitor**, 2000, assistant professor and undergraduate program director

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

**Patricia A. Relue**, 1993, associate professor and graduate program director

B.S.Ch.E., The University of Toledo; M.S.Ch.E., Ph.D., University of Michigan

### EMERITUS FACULTY

**Demetrios D. Raftopoulos**, 1967, professor emeritus

B.S.C.E., Widener College; M.S.C.E., University of Delaware; Ph.D., Pennsylvania State University; PE (Pennsylvania, Ohio, New Jersey)

### PRESTIGE FACULTY

**Steven L. Britton**, 1997, adjunct professor

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**Jeffrey Brown**, 2002, adjunct professor

B.S., Trinity College; M.D., University of Chicago

**Michael J. Dennis**, 1998, adjunct assistant professor

B.S., Xavier University; M.S., University of Cincinnati; Ph.D., University of Texas School of Biomedical Sciences

**Sergio Z. deSalles-Cunha**, 1997, adjunct assistant professor

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**Theodore D. Fraker, Jr.**, 1998, adjunct professor

A.B., Wittenberg University; M.D., Ohio State University

**Gregory M. Georgiadis**, 1997, adjunct assistant professor

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**Lucy S. Goodenday**, 1998, adjunct associate professor

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**James A. Hampton**, 1997, adjunct associate professor

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**James M. Horner**, 1998, adjunct associate professor

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**Jerzy Jankun**, 1997, adjunct associate professor

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**Steven H. Selman**, 1997, adjunct professor

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**Cornel C. VanGorp**, 1999, adjunct assistant professor

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## Department of Chemical & Environmental Engineering

**Martin A. Abraham**, 1996, professor and associate dean for research and graduate studies

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**Michael R. Cameron**, 1988, research associate professor

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**Long Fei Chang**, 1987, research professor

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**Maria R. Coleman**, 1998, associate professor and undergraduate program director

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**Isabel C. Escobar**, 2000, assistant professor  
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**Sharad B. Shah**, 1987, research associate professor  
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## EMERITUS AND SUPERANNUATE FACULTY

**Gary F. Bennett**, 1963, professor emeritus  
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## EMERITUS FACULTY

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**Gerald R. Frederick**, 1966, professor emeritus  
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## 170 College of Engineering

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## Department of Electrical Engineering & Computer Science

**Mansoor Alam**, 1989, professor  
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**Demetrios Kazakos**, 2002, professor and chair  
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### EMERITUS FACULTY

**John Hemdal**, 1986, professor emeritus  
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### PRESTIGE FACULTY

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**Robert J. Abella**, 1988, associate professor  
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## Department of Engineering Technology

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University of Cincinnati; PE (Ohio)

**Ahmet Kahraman**, 1999, associate professor  
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State University

**Theo G. Keith**, 1971, Distinguished University Professor  
B.M.E., Fenn College; M.S.M.E., Ph.D., University of Maryland

**Steven N. Kramer**, 1973, professor and undergraduate program director  
B.S.M.E., M.S.M.E., Ph.D., Rensselaer Polytechnic Institute, PE (Ohio)

**Ioan D. Marinescu**, 1997, professor and director of Precision Micro-  
Machining Center  
B.S., M.S., Polytechnic Institute of Budapest; Ph.D., University of Galatzi

**K. Cyril Masiulaniec**, 1982, associate professor  
B.S.M.E., M.S.M.E., Ph.D., The University of Toledo; PE (Ohio)

**Cedric (Ric) W. Mousseau**, 2000, assistant professor  
B.S.M.E., M.S.M.E., University of Michigan  
– Dearborn; Ph.D., University of Michigan.

**Nagi G. Naganathan**, 1986, professor and interim dean  
B.S.M.E., University of Madras; M.S.M.E., Clarkson University; Ph.D.,  
Oklahoma State University

**Tsung-Ming Terry Ng**, 1991, professor  
B.S., M.S., University of Wisconsin; Ph.D. University of California-  
Berkeley

**Efstratios Nikolaidis**, 2000, professor  
B.S.E., National Technical University of Athens; M.S., Ph.D., University  
of Michigan

**Douglas L. Oliver**, 1985, associate professor  
B.A., University of Washington; M.S.M.E., Ph.D., Washington State  
University, PE (Ohio)

**Walter W. Olson**, 1997, professor  
B.S., U.S. Military Academy; M.S.M.E., Ph.D., Rensselaer Polytechnic  
Institute, PE (Virginia)

**Mehdi Pourazady**, 1986, associate professor  
B.S.M.E., University of Science & Technology-Iran; M.S.M.E.,  
University of Michigan; Ph.D., University of Cincinnati

**Radha Sarma**, 1999, associate professor  
B.Tech., IIT Madras; M.S., The University of Toledo; Ph.D., University  
of Michigan

**Phillip R. White**, 1979, professor  
B.S.M.E., The University of Toledo; M.S.M.E., Ph.D., Purdue University

**Hongyan Zhang**, 2000, assistant professor  
B.S. Jilin University; M.S. Institute of Metal Research, Chinese Academy  
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**Linda J. Bode**, 1985, assistant professor  
A.A.S., B.E.T., M.A., The University of Toledo

**Richard L. Curran**, 1985, associate professor  
B.S.E.Phys., M.S.E.S., The University of Toledo

**Joe P. Elmers**, 1990, assistant professor  
M.S., California Institute of Technology

**William T. Evans**, 1986, associate professor.  
B.S.E.E., University of Illinois; M.S.E.E., The University of Toledo; PE  
(Ohio, Indiana)

**Ahmad Farhoud**, 2000, assistant professor  
B.S., M.S., Ph.D., The University of Toledo

**Ella Fridman**, 1993, assistant professor and graduate program director  
(M.S. in engineering)  
B.S. M.S.M.E., Ph.D., Kiev University

**Ronald E. Gallagher**, 1980, professor  
A.E.T., B.S.C.E., The University of Toledo; PE (Ohio); Surveyor in  
Training (S.I.T.)

**Cyrus K. Hagigat**, 2002, assistant professor  
B.S.M.E., University of Maryland; M.S.C.S., Central Michigan  
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**James L. Kamm**, 1974, professor  
B.S., Carnegie Institute of Technology; Ph.D., The Ohio State University

**Norman A. Koenigsecker**, 1988, associate professor and director, degree  
completion programs  
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**Nicholas Kissoff**, 1999, assistant professor and director of undergraduate  
program (C.E.T.)  
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**Frederick J. Nelson**, 1985, associate professor and director of  
undergraduate program (C.S.E.T./E.E.T.)  
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**Mohammed Y. Niamat**, 1990, associate professor  
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