

# COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

## Engineering: The Profession

Engineers are the link between scientific knowledge and practical applications. Engineers combine various roles and functions in their job. What are engineers?

- Engineers are science-knowledgeable individuals who use mathematics, chemistry, and physics for an applied purpose.
- Engineers invent, design, or improve products that people want to buy or use.
- Engineers are business people who design, manufacture, or sell a technical product or service to customers, taking into consideration safety, cost, quality, reliability, societal impact, and ease of use.
- Engineers are planners and integrators who bring together skills and knowledge from many disciplines and fields for some technical purpose or application.
- Engineers are creative problem-solvers and doers: they make decisions and get things done in a combined science/technical/business/applied profession.
- Engineers analyze problems, develop design solutions, and pay close attention to detail.
- Engineers interact with a variety of people, including clients, scientists, other engineers, technicians, managers, and government officials.
- Engineers are interested in how and why things work and like practical challenges.
- Successful engineers are known for their analytical, imaginative, and creative skills, for using common sense, for being team players, for being able to pick up new knowledge and skills quickly, and for their commitment to continue to improve and learn.

The College of Engineering and Computer Science offers undergraduate engineering degrees in eight fields: Bioengineering, Computer Engineering, Electrical Engineering, Human Centered Engineering Design, Industrial and Systems Engineering, Manufacturing Engineering, Mechanical Engineering, and Robotics Engineering.

## Computer Science: The Profession

Computer and information scientists offer expertise in the effective and efficient use of computers for tackling a broad spectrum of practical challenges, usually in a team environment. Computer and information science includes the following sub-specialties: operating systems, compilers, computer graphics, computer game design, computer networks and network administration, security, enterprise computing technologies, information and database systems and database administration, information retrieval, artificial intelligence and machine learning, robotics, theoretical computer science, programming languages, software engineering and web technologies. Software engineering is the area within computer science that is concerned with the theoretical and practical aspects of the detailed design, building, testing, modification, optimization, and maintenance of large, high quality, software systems for a wide range of applications across society. Software engineers analyze users' needs and work as part of a core team to design, create, and implement high quality and cost effective new software, computer applications, and utility programs. A core team may be composed of software engineering, manufacturing, design, management, and

marketing people who work together until the software product is released and implemented.

Data scientists use programming, mathematics/statistics, and modeling skills to convert data for companies, governments, and other institutions into actionable information and insight. Cybersecurity and Privacy is the area of computer science concerned with fundamental security and privacy concepts including confidentiality, integrity, access control, security architecture and systems, and attack/defense in various application areas, ranging from computer security to network security, from wired security to wireless security, from data security to application security, from every day security to enterprise security.

The College of Engineering and Computer Science offers undergraduate degrees in four computer science fields: Computer and Information Science, Cybersecurity and Information Assurance, Data Science, and Software Engineering.

## Career Choice

What can help students to decide to pursue a career in engineering or computer science? Some of the clues are an interest in and successful completion of science, mathematics, and computer science courses; a desire and ability to investigate the "why" as well as the "how" of things; and an interest in the creative development of devices or systems that meet specific needs. Not all of these signs or interests will fit everyone, but they can be used as a guide.

Individuals with interests in using science and mathematics to benefit others will find that engineering and computer science professions offer a wide variety of career and employment choices and opportunities.

Admissions counselors at UM-Dearborn and academic advisors of the College of Engineering and Computer Science are glad to talk with students about career choices or choosing the school that best suits their interest and abilities. Prospective students are welcome to contact the College of Engineering and Computer Science and to read the information on the College's web page.

## Educational Goals and Programs

*The mission of the College of Engineering and Computer Science is to be a leader in providing quality undergraduate and graduate programs in an environment integrated with engineering practice, research, and continuing professional education, in close partnership with the industrial community.*

The College of Engineering and Computer Science's (CECS) educational objective is to prepare its students to take positions of leadership commensurate with their interests and abilities in a world where science, engineering, and human relations are of basic importance.

Programs of study integrate fundamental mathematical and scientific theory with experiments, advanced analysis, and design practice to produce the coherent educational preparation required of professional engineers and computer scientists.

Both the CECS academic curriculum and experiential learning opportunities are planned to prepare students to become practicing engineers or computer scientists, administrators, or investigators. The knowledge, skills, and discipline gained from the CECS degree programs are broad and fundamental and also constitute excellent preparation for other careers, such as law and medicine.

## Undergraduate Requirements

The College of Engineering and Computer Science (CECS) offers undergraduate programs leading to the Bachelor of Science in Engineering (BSE) degree in the following fields: Bioengineering, Computer Engineering, Electrical Engineering, Human Centered Engineering Design, Industrial and Systems Engineering, Manufacturing Engineering, Robotics Engineering, and Mechanical Engineering. (Students in these BSE programs may also choose to earn a concurrent second degree in Engineering Mathematics.) The College also offers an undergraduate degree program leading to a Bachelor of Science (BS) in the following fields: Computer and Information Science, Cybersecurity and Information Assurance, Data Science, and Software Engineering. The CIS program has four concentrations: artificial intelligence, computer science, information systems, and game design. The CIA program has two concentrations: digital forensics and cybersecurity and privacy. (Students in these BS programs may also choose to earn a concurrent second degree in CIS Mathematics.)

The minimum credit-hour requirement for the degree programs in engineering is 125 to 128 semester credits, depending on the specific major. The BS in Software Engineering, Data Science, Cybersecurity and Information Assurance, or in Computer and Information Science requires a minimum of 120 to 123 semester credits of course work, depending on the specific major.

CECS students can also choose from several concurrent undergraduate degree programs, an opportunity to earn two engineering or computer science degrees by completing an additional 15-18 credits.

The scholastic requirements for graduation are given under the "Academics" sections of this *Catalog*. For the detailed requirements specified by the College of Engineering and Computer Science for each of its undergraduate programs, see the sections below.

Students have the option of earning a minor in addition to their major. CECS offers minors in Artificial Intelligence, Computer and Information Science, and Game Design. The College of Arts, Sciences, and Letters and the College of Business offer various minors of interest to CECS students. See the relevant sections of this *Catalog*.

The CECS Office of Advising and Academic Success, 313-593-5510, [umd-cecs-undergrad@umich.edu](mailto:umd-cecs-undergrad@umich.edu), is the primary contact for undergraduate students for academic advising and for information about all undergraduate degree programs of the College of Engineering and Computer Science.

## Admission to the College of Engineering and Computer Science

Undergraduate students interested in Engineering or Computer Information Science majors can be admitted into the College of Engineering and Computer Science (CECS) in one of two ways:

### 1. Admission directly into a CECS major

#### Freshman Requirements for Direct Admission:

- Students with a GPA of 3.5 or higher AND an SAT of 1200 (ACT of 25) or higher, or
- Students who have completed at least Pre-Calculus (Math 105 or equivalent) with a C grade or higher, or
- Students who place into Calculus 1 (Math 115) or higher on their placement exam or via the following automatic placements:

- SAT math section score of 620 or higher
- ACT math score of 26 or higher
- 3, 4, or 5 on an AP Calculus exam
- 5 or higher on an IB Mathematics SL exam or a 4 or higher on an IB Mathematics HL or HL Further exam

#### Transfer Requirements for Direct Admission:

- Students who have completed Calculus II (Math 116 or equivalent) elsewhere with a C grade or higher AND have an overall GPA of 2.75 or higher.

### 2. Admission into the Pre-Engineering Program

#### Freshman Requirements:

- Students who satisfy the university's undergraduate admissions standards, but do not meet the above admission criteria for direct admit into CECS.

#### Transfer Requirements:

- Students will be required to show an overall transfer GPA of 2.75 or higher.

#### What is Pre-Engineering?

This program is designed to support students in building a stronger math and science foundation to be successful in the rigorous CECS curriculum. Pre-Engineering students will have excellent campus support in developing the fundamental knowledge our faculty have identified as key predictors of success in the engineering and computer science fields.

#### Transitioning from Pre-Engineering into a CECS Major:

Pre-Engineering students will work closely with Academic Advisors to enroll in appropriate classes to help ensure their chances are optimized to be successful in the intensive curriculum that lies ahead. Students following the Pre-Engineering path are expected to complete the transition expectations (below) within one calendar year or within their first 30 credit hours at UM-Dearborn, whichever comes first. At the completion of one year or 30 credit hours, students are required to declare a major in CECS (if they qualify), or in a different academic college on campus (if they do not qualify). Some students may complete their Pre-Engineering coursework within one semester.

- Freshmen can transition once they successfully **complete Pre-Calculus** (Math 105) with a **C grade or higher**
- Transfer students can transition once they successfully **complete Calculus II** (Math 116) with a **C grade or higher**.
- All students transitioning into a CECS major are expected to be in good academic standing overall (2.0 GPA or higher).

## CECS Office of Advising and Academic Success

The College of Engineering and Computer Science (CECS) Office of Advising and Academic Success is the primary contact for undergraduate students for academic advising and for information about all undergraduate CECS programs. The office provides the following services to CECS undergraduate students:

- academic advising of new and continuing students
- evaluation of transfer credits, admission of cross-campus transfer applicants
- handling of petitions and individual requests
- degree audits of students' credits toward graduation
- placement and release of academic holds
- handling of academic (probationary) actions and petitions
- readmission of previously enrolled students
- final certification of degree completion.

The CECS Office of Advising and Academic Success is located in 1084 Engineering Lab Building (ELB), (phone: 313-593-5510).

## Majors

- Bioengineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/bioengineering/#majortext>) (also offered as Dual Degree)
- CIS Mathematics (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/cis-mathematics/#majortext>)
- Computer and Information Science (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/computer-information-science/#majortext>) (also offered as Dual Degree)
- Computer Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/computer-engineering/#majortext>) (also offered as Dual Degree)
- Cybersecurity and Information Assurance (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/cyber-security-information-assurance/>) (also offered as Dual Degree)
- Data Science (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/data-science/>) (also offered as Dual Degree)
- Electrical Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/electrical-engineering/#majortext>) (also offered as Dual Degree)
- Engineering Mathematics (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/engineering-mathematics/#majortext>)
- Industrial and Systems Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/industrial-systems-engineering/#majortext>) (also offered as Dual Degree)
- Human Centered Engineering Design (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/human-centered-engineering-design/>)
- Manufacturing Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/manufacturing-engineering/#majortext>) (also offered as Dual Degree)
- Mechanical Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/mechanical-engineering/#majortext>) (also offered as Dual Degree)
- Robotics Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/robotics-engineering/#majortext>)
- Software Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/software-engineering/#majortext>)

## Minors

- Artificial Intelligence (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/artificial-intelligence/>)
- Computer and Information Science (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/computer-information-science/#minortext>)
- Game Design (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/game-design/>)

## Certificates

- Energy and Sustainability (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/energy-sustainability/>)
- Engineering Design (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/engineering-design/>)
- Engineering Mechanics (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/engineering-mechanics/>)
- Materials and Manufacturing (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/materials-manufacturing/>)
- Mechatronics and Robotics (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/mechatronics-robotics/>)
- Vehicles and Mobility (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/vehicles-mobility/>)
- Practical Aspects of Computer Security (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/practical-aspects-computer-security/>)

## Dual Degree Programs

- BSE, Bioengineering/Mechanical Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/dual-degree/bio-eng-mechanical-eng/>)
- BS, Computer and Info Systems/Cybersecurity (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/dual-degree/comp-info-and-cybersecurity/>)
- BS, Computer and Info Systems/Data Science (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/dual-degree/comp-info-data-science/>)
- BSE, Electrical/Computer Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/dual-degree/electrical-computer-engineering/>)
- BSE, Industrial and Systems Engineering/Manufacturing Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/dual-degree/industrial-systems-manufacturing-eng/>)
- BSE, Manufacturing/Mechanical Engineering (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/dual-degree/manufacturing-mechanical-eng/>)

## Administration

Ghassan Kridli, PhD, Dean

Di Ma, PhD, Associate Dean for Graduate Education and Research

Brahim Medjahed, PhD, Associate Dean for Undergraduate Education

John Cristiano, PhD, Assistant Dean for Research Development and Strategic Initiatives and Co-Director, Institute for Advanced Vehicle Systems,

Anthony DeLaRosa, MA, Assistant Director, Experiential Learning and Co-op Education

Eric Kirk, Director, Facilities and Laboratory Safety

Leigh McGrath, BS, Director, Business Operations

Lisa Remsing Hall, PhD, Director, Advising and Academic Success

Susan Guinn, MA, Director, CECS Online

## Chairs and Directors

Oleg Zikanov, Chair, Department of Mechanical Engineering

Paul Richardson, Chair, Department of Electrical and Computer Engineering

Armen Zakarian, Chair, Department of Industrial and Manufacturing Systems Engineering

Qiang Zhu, Chair, Department of Computer and Information Science

## Professors Emeriti

Aswad, A. Adnan, PhD, Professor Emeritus of Industrial and Manufacturing Systems Engineering

Bolling, Fredric, PhD, Professor Emeritus of Mechanical Engineering

Chang, Chia-hao, PhD, Professor Emeritus of Industrial and Manufacturing Systems Engineering

Despres, Thomas A., PhD, Professor Emeritus of Mechanical Engineering

England, Anthony, PhD, Professor Emeritus of Electrical and Computer Engineering and Dean Emeritus College of Engineering and Computer Science

Habib, Izzeddin S., PhD, Professor Emeritus of Mechanical Engineering

Kachhal, Swatantra K., PhD, Professor Emeritus of Industrial and Manufacturing Systems Engineering

Kampfner, Roberto, PhD, Associate Professor Emeritus of Computer and Information Science

Knight, James W., PhD, Associate Professor Emeritus of Industrial and Manufacturing Systems Engineering

Miller, John, PhD, University of Toledo, Associate Professor of Electrical and Computer Engineering

Murtuza, Syed, PhD, Professor Emeritus of Electrical and Computer Engineering

Tsui, Louis, PhD, Associate Professor Emeritus of Computer and Information Science

Varde, Keshav, PhD, Professor Emeritus of Mechanical Engineering

## Faculty

### Department of Computer and Information Science

Abouelenien, Mohamed, PhD, University of North Texas, Assistant Professor of Computer and Information Science

Akingbehin, Kiumi, PhD, Wayne State University, Professor of Computer and Information Science

Bacha, Anys, PhD, Ohio State University, Assistant Professor of Computer and Information Science

Eshete, Birhanu, PhD, University of Trento, Assistant Professor of Computer and Information Science

Guo, Jinhua, PhD, University of Georgia, Associate Professor of Computer and Information Science

Hassan, Foyzul, PhD, University of Texas at San Antonio, Assistant Professor of Computer and Information Science

Kessentini, Marouane, PhD, University of Montreal, Associate Professor of Computer and Information Science

Lu, Jin, PhD, University of Connecticut, Assistant Professor of Computer and Information Science

Ma, Di, PhD, University of California-Irvine, Professor of Computer and Information Science

Maxim, Bruce, PhD, University of Michigan, Professor of Computer and Information Science

Medjahed, Brahim, PhD, Virginia Tech University, Professor of Computer and Information Science

Meneghetti, Niccolo, PhD, State University of New York at Buffalo (SUNY Buffalo), Assistant Professor of Computer and Information Science

Neji, Sana, MBA\MS, University of Quebec, Lecturer III IV of Computer and Information Science

Ortiz, Luis, PhD, Brown University, Associate Professor of Computer and Information Science

Ortiz, Luis, PhD, Brown University, Associate Professor of Computer and Information Science

Roy, Probir, PhD, College of William and Mary, Assistant Professor of Computer and Information Science

Shen, Jie, PhD, University of Saskatchewan, Professor of Computer and Information Science

Song, Zheng, PhD, Virginia Tech, Ph.D., Beijing University of Posts and Telecomm., Assistant Professor of Computer and Information Science

Wang, Shengquan, PhD, Texas A M University, Associate Professor of Computer and Information Science

Xu, Zhiwei, PhD, Florida Atlantic University, Associate Professor of Computer and Information Science

Yoon, David, PhD, Wayne State University, Associate Professor of Computer and Information Science

Zhu, Qiang, PhD, University of Waterloo, Professor of Computer and Information Science

### Department of Electrical and Computer Engineering

Awad, Selim Saad, PhD, Polytechnic Institute of Grenoble, Professor of Electrical and Computer Engineering

El Kateeb, Ali, PhD, Concordia University, Associate Professor of Electrical and Computer Engineering

Farooq, Junaid, PhD, New York University, Assistant Professor of Electrical and Computer Engineering

Hafeez, Azeem, PhD, University of Michigan-Dearborn, Lecturer III of Electrical and Computer Engineering

Hong, Junho, PhD, Washington State University, Assistant Professor of Electrical and Computer Engineering

Kim, Taeyhung, PhD, Texas A M, Associate Professor of Electrical and Computer Engineering

Kwon, Jaerock, PhD, Texas A&M University, Assistant Professor of Electrical and Computer Engineering

Lakshmanan, Sridhar, PhD, University of Massachusetts Amherst, Associate Professor of Electrical and Computer Engineering

Malik, Hafiz, PhD, University of Illinois At Chicago, Professor of Electrical and Computer Engineering

Mohammadi, Alireza, PhD, University of Toronto, Assistant Professor of Electrical and Computer Engineering

Murphey, Yi Lu, PhD, University of Michigan, Professor of Electrical and Computer Engineering

Putty, Michael, PhD, University of Michigan, Lecturer IV of Electrical and Computer Engineering

Rawashdeh, Samir, PhD, University of Kentucky, Associate Professor of Electrical and Computer Engineering

Richardson, Paul C., PhD, Oakland University, Professor of Electrical and Computer Engineering

Shaout, Adnan, PhD, Syracuse University, Professor of Electrical and Computer Engineering

Su, Wencong, PhD, North Carolina State University, Associate Professor of Electrical and Computer Engineering

Wang, Mengqi, PhD, North Carolina State University, Associate Professor of Electrical and Computer Engineering

Watta, Paul, PhD, Wayne State University, Associate Professor of Electrical and Computer Engineering

Wei, Lu, PhD, Aalto University, Assistant Professor of Electrical and Computer Engineering

Xiang, Weidong, PhD, Tsinghua University, Professor of Electrical and Computer Engineering

Yi, Yasha, PhD, Massachusetts Institute of Technology, Professor of Electrical and Computer Engineering

Zhao, Dongming, PhD, Rutgers University, Professor of Electrical and Computer Engineering

### Department of Industrial Manufacturing Systems Engineering

Ayoub, Georges Y., PhD, University of Lille, Associate Professor of Industrial and Manufacturing Systems Engineering

Bao, Shan, PhD, University of Iowa, Associate Professor of Industrial and Manufacturing Systems Engineering

Bayram, Armagan, PhD, University of Massachusetts, Assistant Professor of Industrial and Manufacturing Systems Engineering

Chehade, Abdallah, PhD, University of Wisconsin-Madison, Assistant Professor of Industrial and Manufacturing Systems Engineering

Chen, Yubao, PhD, University of Wisconsin-Madison, Professor of Industrial and Manufacturing Systems Engineering

Feng, Fred, PhD, University of Michigan, Ann Arbor, Assistant Professor of Industrial and Manufacturing Systems Engineering

Hu, Jian, PhD, Northwestern University, Associate Professor of Industrial and Manufacturing Systems Engineering

Hu, Zhen, PhD, Missouri University of Science and Technology, Assistant Professor of Industrial and Manufacturing Systems Engineering

Jia, Bochen, PhD, Virginia Polytechnic Institute and State University, Associate Professor of Industrial and Manufacturing Systems Engineering

Kim, Sang-Hwan, PhD, North Carolina State University, Associate Professor of Industrial and Manufacturing Systems Engineering

Klungle, Roger, D.Sc., George Washington University, Lecturer III of Industrial and Manufacturing Systems Engineering

Kridli, Ghassan, PhD, University of Missouri-Columbia, Professor of Industrial and Manufacturing Systems Engineering

Lee, Cheol, PhD, Purdue University, Associate Professor of Industrial and Manufacturing Systems Engineering

Tolbert, DeLean, PhD, Purdue University, Assistant Professor of Industrial and Manufacturing Systems Engineering

Ulgen, Onur, PhD, Texas Technological University, Professor of Industrial and Manufacturing Systems Engineering

Zakarian, Armen, PhD, University of Iowa, Professor of Industrial and Manufacturing Systems Engineering

Zhou, Feng, PhD, Georgia Institute of Technology, Assistant Professor of Industrial and Manufacturing Systems Engineering

### Department of Mechanical Engineering

Argento, Alan, PhD, University of Michigan, Professor of Mechanical Engineering

Casquero Penelas, Hugo, PhD, Universidade da Coruna, Assistant Professor of Mechanical Engineering

Chen, Lei, PhD, National University of Singapore, Assistant Professor of Mechanical Engineering

Cherng, John G., PhD, University of Tennessee, Professor of Mechanical Engineering

Esquivel, Amanda, PhD, Wayne State University, Associate Professor of Bioengineering

Ghosh, Gargi, PhD, University of Kentucky, Associate Professor of Bioengineering

Huntley, Hugh, PhD, University of Michigan, Associate Professor of Mechanical Engineering

Jayaraman, Tanjore, PhD, University of Utah, Assistant Professor of Mechanical Engineering

Jung, Dohoy, PhD, University of Michigan, Professor of Mechanical Engineering

Kanapathipillai, Mathumai, PhD, Iowa State University, Associate Professor of Bioengineering

Kang, Hong Tae, PhD, University of Alabama, Professor of Mechanical Engineering

Kim, Doohyun, PhD, University of Michigan, Assistant Professor of Mechanical Engineering

Kim, Youngki, PhD, University of Michigan, Assistant Professor of Mechanical Engineering

Lee, Byungchan, PhD, University of Michigan, Lecturer III of Mechanical Engineering

Li, Ben Q., PhD, University of California-Berkeley, Professor of Mechanical Engineering

Lo, Joe Fu-Jiou, PhD, University of Southern California, Associate Professor of Bioengineering

Mallick, Pankaj K., PhD, Illinois Institute of Technology, Professor of Mechanical Engineering

Mei, Carole, PhD, University of Auckland, Professor of Mechanical Engineering

Mohanty, Pravansu, PhD, McGill University, Professor of Mechanical Engineering

Pannier, Christopher, PhD, University of Michigan, Assistant Professor of Mechanical Engineering

Ratts, Eric, PhD, Massachusetts Institute of Technology, Associate Professor of Mechanical Engineering

Reyes-Villanueva, German, PhD, University of Liverpool, Associate Professor of Mechanical Engineering

Sengupta, Subrata, PhD, Case Western Reserve University, Professor of Mechanical Engineering

Shim, Taehyun, PhD, University of California-Davis, Professor of Mechanical Engineering

Zhang, Yi, PhD, University of Illinois at Chicago, Professor of Mechanical Engineering

Zikanov, Oleg, PhD, Moscow State University, Professor of Mechanical Engineering

## Cooperative Education

The College of Engineering and Computer Science recognizes that experience-based learning, through cooperative education and internship programs, is an integral component to a student's college experience that provides life-changing learning opportunities. The Cooperative Education Program is an optional program for students who desire paid practical work experiences related to their academic program of study and to their career interest. Co-op students may perform their assignments in alternating semesters of full-time employment and full-time course work, or by completing the co-op assignments in the summer. Students who complete the Cooperative Education program requirements receive recognition on their transcripts.

Cooperative education assignments are supervised by representatives of both the University and the employer. The work experience is considered an integral part of the educational process, and both the College and the participating employer share responsibility for this integration. These assignments can be in-state or out-of-state. Students in the Cooperative Education Program are required to complete a minimum of two-credit hours (two co-op assignments) to receive the transcript recognition.

Students with majors in the Computer and Information Science Department, may use multiple cooperative education credits (see your advisor to determine maximum permitted credits) towards fulfilling the basic requirements for their degree program. Students with majors in all other CECS Departments may use up to 1 (one) cooperative education credit towards fulfilling the basic requirements for their degree program.

Students are encouraged to complete a minimum of two full-time co-op work semesters with a participating employer; however, the co-op assignments may be completed with different employers. Students may enroll in up to two academic classes concurrently with their cooperative education assignment.

## Student Counseling and Placement

The Director of the CECS Cooperative Education Program counsels co-op students with respect to career interests and aptitudes and connects students with appropriate employers for interviews. These interviews furnish the opportunity for a professional work assignment that is agreeable to the University, the student, and the employer.

## Evaluation, Eligibility and Recognition of Achievement

At the end of the cooperative education assignment (end of semester) each student is formally evaluated by the employer. The participating student submits a technical report to the faculty member responsible for the cooperative education class for grading.

The grade for the cooperative education class is determined based on the quality of the technical report and the employer evaluation (details on the grading rubric will be provided to the students in the cooperative education course syllabus.) If the cooperative education assignment is counted for academic credit toward the degree, it is graded on a scale from A to E. However, if the cooperative education course is completed for additive credit, the assigned grade will be either *S* for satisfactory or *NC* (no credit) for unsatisfactory. Failure to submit the report by the due date will result in failing the course (receiving a grade of E or NC).

Students are eligible to participate in the Cooperative Education Program and register for co-op courses by meeting pre-requisite courses.

These pre-requisite courses are specific to the student's academic program of study. Transfer students are eligible to participate in the Cooperative Education Program once they have completed one semester of enrollment in one of the academic programs offered by the College and have met the appropriate pre-requisite courses.

Participating employers and the University expect that students engaged in the Cooperative Education Program will be able to demonstrate a considerable increase in academic knowledge after each term of classroom study. Therefore, students in the CECS Cooperative Education Program must be full-time students during their alternated class terms; that is, must satisfactorily complete at least 12 credit hours of their degree program course work during each scheduled class term.

To earn cooperative education recognition on their transcripts, students must complete at least two full-time assignments. With prior registration, one cooperative education credit-hour may be earned for each full-time cooperative education assignment. A full-time assignment requires at least 34+ hours of work per week for 12 to 15 consecutive weeks in a semester.

In engineering programs, with departmental faculty pre-approval, one of the cooperative education assignments may also be counted for academic credit (i.e., to satisfy the requirements of the undergraduate degree program.) In such a case, the recognition on the transcript requirements for the Cooperative Education Program can be fulfilled with only one additional credit hour of cooperative education beyond the requirements of the degree program. For students with majors in the Computer and Information Science Department, both cooperative education assignments may be completed for academic credit towards the undergraduate degree program.

## Admission to the Cooperative Program

Students who have completed the pre-requisite courses and have good academic standing, can join the CECS Cooperative Education Program. Typically, students meet these requirements towards the end of their sophomore year. Transfer students admitted to the CECS are eligible to participate in the Cooperative Education Program after completing the pre-requisite courses and one semester as a full-time student, or 12 credit hours. A GPA of at least 2.00 is a pre-requisite to admission into the program.

The basic course requirements include the calculus sequence, differential equations, linear algebra, college chemistry, the engineering physics sequence, and introductory courses in engineering that include computer-aided tools for design and analysis.

In addition to the basic entrance-level requirements there are also specific courses that must be satisfactorily completed before beginning the first co-op work period. These specific courses, which differ according to the degree programs, are all courses normally scheduled in the sophomore year under CECS's basic freshman-sophomore curriculum (the equivalent course at another college may be acceptable for a transfer student).

- For students majoring in computer and information science, cybersecurity and information assurance, data science, or software engineering, the pre-requisite to the Cooperative Education Program is: Discrete Structures I (CIS 275).
- For students majoring in computer engineering, electrical engineering or robotics engineering, the pre-requisites to the Cooperative Education Program are: (1) Circuits (ECE 210) and (2) Digital Systems (ECE 273).

- For students majoring in industrial and systems engineering, manufacturing engineering, or human-centered engineering design, the pre-requisites to the Cooperative Education Program are: (1) C Programming (IMSE 255) and (2) Engineering Probability and Statistics (IMSE 317).
- For students majoring in bioengineering or mechanical, the pre-requisites to the Cooperative Education Program are: (1) Engineering graphics (ENGR 126) and (2) Computer Methods (ENGR 216) and (3) Engineering Materials (ENGR 250), and (4) [Thermodynamics (ME 230) or Design Stress Analysis (ME 260)].

The purpose of these course requirements is to prepare the co-op student academically for professional work assignments where there will be continual daily association with practicing engineers. Through fulfillment of these requirements the co-op student will have sufficient competence to perform technical work and function as a member of an engineering group.

## Registration in the Cooperative Education Program

Each co-op work assignment extends for one term (four months) and **occupies the student full-time**. From a group of co-op courses available, the co-op student, in consultation with the Director of the CECS Cooperative Education Program, elects a course whose content is appropriate to the level of practice being undertaken that term. Three such registrations are recommended (two are required) for satisfactory completion of the Cooperative Education Program. Since the student co-op work assignment is full-time, enrollment in courses other than the co-op course is strongly discouraged. However, a student on a co-op assignment may register for a maximum of two other courses during the semester (the recommendation is no more than one course along with the co-op course).

In some instances, students may be involved in a cooperative-type educational program prior to their eligibility for and/or acceptance into the Engineering Cooperative Education Program. Such cooperative-type programming might occur either while enrolled at UM-Dearborn or at another educational institution. However, employment completed prior to formal enrollment in the CECS Cooperative Education Program cannot be used for satisfying the requirements of the CECS Cooperative Education Program or degree program.

## CECS Internship Program

The Cooperative Education Office also provides students with degree-related internship opportunities. The College of Engineering and Computer Science defines internships as flexible work experiences performed on a part-time basis during the academic year and possibly full-time in the summer. Internships provide valuable work experience but are performed without supervision of a university representative and students do not receive transcript recognition for their internship work. Like the Cooperative Education Program co-op assignments, students are paid by their employers for their internship work. Since internships are part-time employment, they do not require university registration in a special internship course. Furthermore, students engaged in an internship may enroll full-time in additional academic courses. However, students pursuing an internship are strongly recommended to discuss their overall workload (academic and employment) with an academic advisor in the CECS Office of Advising and Academic Success.

## CECS Experiential Honors Program

The CECS Experiential Honors Program inspires the intellectual and leadership growth of students beyond academics. The program equips

students with knowledge and skills that enhance their leadership and their preparedness to meet the challenges of their future engineering careers.

## Program Features

The Experiential Honors Program has two groups of elements: An Academic Element and Experiential and Leadership Elements. The Academic Element provides knowledge on design innovation and entrepreneurship. The Experiential and Leadership Elements focus on implementing academic knowledge in professional experience, engineering design, and/or engineering research.

Students will earn recognition for each element of the program by enrolling in a faculty supervised Experiential Honors course associated with the program element. Those who complete 1) the Academic Elements, 2) a faculty supervised internship (ENGR 399), 3) an Experiential Honors Research project, and 4) an Experiential Honors Design project, will receive an Experiential Honors notation on their transcripts upon graduation. It is worth noting that all program requirements can be completed within the academic requirements of the student's degree program.

## Who is eligible to participate?

The program is open to all students at CECS who are in good academic standing and who are interested in extending their educational experience beyond the classroom. The program is open to freshmen and transfer students who have completed at least one semester of study on campus.

Students can join the program by completing an application form indicating their goals, their commitment to achieving these goals and their vision for incorporating the goals into their education. The program is open to all students and has no GPA requirement; however, to receive recognition, the students must accomplish the program elements and spend at least 4 full semesters of active participation.

## How to Apply

1. Attend an informational session about the program or meet with the program director.
2. Identify a Faculty Advisor from your academic program who will guide you and mentor you in the Experiential Honors program.
3. Submit the program application by the due date.

For more information, visit the Experiential Honors Program website (<https://umdearborn.edu/cecs/undergraduate-programs/experiential-honors-program/>).

## Why Apply to the Program

1. Work on experiential projects that bridge the gap between engineering education and practice.
2. Work on experiential research or design project above and beyond the requirements of the regular curriculum.
3. Develop leadership skills.
4. Receive recognition on your transcripts for participating in the program.

## Elements of the Program

- Academic Elements:
  - Complete at least one of the following courses (3 to 4 credit hours) that may also count as electives in your academic program:

- i. ENGR 360 (4 cr. hrs.): Design Innovation: Process, Method and Practice
- ii. ENT 400 (3 cr. hrs.): Introduction to Entrepreneurship
- iii. ENGR 400 (3 cr. hrs.): Applied Business Techniques for Engineers

- Experiential Learning and Leadership Elements:

Students are expected to enroll in a minimum of one credit hour (ENGR 399, ENGR 492 or ENGR 493) for each semester of active participation of the program. These count toward fulfilling the professional elective requirements of the student's academic degree.

- Complete a semester long faculty supervised professional experience (ENGR 399, 1 cr. hr.)
- Complete 2 or 3 credit hours (1 cr. hr. per semester) in one or both of the following courses:
  - a. Experiential Honors Directed Research Project (ENGR 492, 1 to 3 cr. hrs).
  - b. Complete Experiential Honors Directed Design Project (ENGR 493, 1 to 3 cr. hrs.) for performing hardware or software design for one of the CECS student club teams (e.g. SAE, MASA, etc.). Credit for ENGR 493 can also be earned for completing an industry/community/NGO sponsored "honors" design project\*.

\*The "Honors" Design Project is completed under the guidance of an "expert" who will challenge you to recognize and address global, economic, environmental, and societal impacts and implications of your proposed solution. An acceptable "honors" project is expected to require at least 50 clock hours of additional work during the semester in which the project is completed.

The project approval process involves:

- Identifying a topic of interest
- Identifying a faculty advisor to guide the project (if the topic is outside the expertise of your Experiential Honors Advisor).
- Presenting the outcome of your project at the end of the semester in which the course is taken.
- Submitting a project report that includes a reflection on the project and the lessons learned.

The honors design project may be an expansion of the scope of a senior design project. The credit hours for each activity is determined by the Faculty Advisor based on the effort required to complete the activity.

## Grand Challenge Scholars Program National Academy of Engineering's Grand Challenge Scholars Program

The National Academy of Engineering (NAE) Grand Challenges for Engineering (<http://www.engineeringchallenges.org/challenges.aspx>) present an aspirational vision of what engineering needs to deliver to all people on the planet in the 21st century:

*"Continuation of life on the planet, making our world more sustainable, secure, healthy, and joyful."*

The vision is based on 14 Grand Challenges (<http://www.engineeringchallenges.org/challenges.aspx>) that the NAE recognized as necessary to deliver this vision in the 21st century.

The University of Michigan-Dearborn is one of 92 engineering colleges and schools world-wide selected by the NAE to implement a program



to inspire practical projects for their students through an educational supplement called the Grand Challenges Scholars Program (GCSP). This program provides students educational experiences, inside and outside the classroom, necessary to develop the five competencies needed to address these global challenges.

*The program is open to all CECS undergraduate students in good academic standing. As a Grand Challenge Scholar, you will have the opportunity to focus your undergraduate education on a topic aligned with your passion, within the structure of your degree program (no additional credits). This experience will provide you a deeper understanding and appreciation for the breadth of perspectives needed to address the selected challenge.*

## Engineering Learning Center

The mission of the Engineering Learning Center (ELC) (<https://umdearborn.edu/cecs/undergraduate-programs/engineering-learning-center/>) is to support the academic success of the College of Engineering and Computer Science (CECS) students in an open, inclusive, and student-focused environment that fosters students' ownership of their learning journey, in close partnership with faculty, staff, students, alumni as well as university and industry partners.

### Our Approach

The ELC supports its mission through a holistic approach to learning and success that includes a variety of services and programs such as free tutoring, boot-camps, exam preparation, success coaching, and guided study sessions. ELC services are tailored to engineering and computer science students, programs, and courses and cover major courses across the four CECS departments. The ELC services and programs are provided in collaboration with faculty, staff, students, alumni, and industry partners. The center complements and coordinates with existing UM-Dearborn academic success resources such as the Office of Academic Success, Experience+, Talent Gateway, peer learning centers (math, science, and writing), and the Mardigian Library.

The ELC is located in Room 1170 of the Heinz Prechter Engineering Complex (HPEC).

## Study Abroad Opportunities

### Student Exchange Programs with the Jönköping School of Engineering in Jönköping, Sweden and the Ulm University of Applied Sciences in Ulm, Germany

The College of Engineering and Computer Science offers two study abroad opportunities. Our exchange programs with Ulm University of Applied Sciences in Germany and Jönköping University in Sweden are a great way to gain intercultural experience while fulfilling degree requirements. Students register for a full-time course load and pay their normal UM-Dearborn tuition. All courses are taught in English and designed with exchange students in mind. To maintain full-time status and financial aid, students typically enroll in three technical courses and one language/culture course. Courses taken abroad count toward students' UM-Dearborn GPA. Students register for courses at UM-Dearborn and pay their normal tuition. There is no extra fee to participate, but students should budget for living expenses, such as housing, food, airfare, and travel. All CECS majors in good academic standing are eligible to apply.

Please contact the Office of Advising and Academic Success to discuss these opportunities with your advisor, or visit the Office of International Affairs for information about additional study abroad programs.

## Career Opportunities

A wide variety of employment opportunities is available to engineering and computer science graduates, as mentioned above. The University's Office of Career Services offers numerous services to students and graduates in preparing for careers and in searching for professional employment in a chosen field.

## Student Organizations

CECS students are involved in a wide variety of student organizations at UM-Dearborn. We have nearly two dozen clubs, teams, and professional organizations that will challenge students to problem solve, make connections, and prepare for a fulfilling career in engineering.