Software engineering is the area of computer science concerned with the examination and analysis of computer hard drives, storage devices, cell phones, PDAs or any electronic device that may hold evidence that could be used in a court of law. The digital forensics analyst uncovers and preserves data for later use as legal evidence, and analyzes the data in light of a particular crime or criminal or civil investigation. 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.

The College of Engineering and Computer Science, Office of Advising and Academic Success, has online information about careers in engineering and computer science and a number of links to very informative external web sites.

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 cooperative education placements 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, 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 (CIS), Cybersecurity and Information Assurance (CIA), Data Science, and Software Engineering. The CIS program has three concentrations: 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 “Requirements for Graduation” section 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 for each program below.

Students have the option of earning a minor in addition to their major. CECS offers a minor in Computer and Information Science. 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, 2000 Heinz Prechter Engineering Complex (HPEC), 313-593-5510, 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

Admission to the College of Engineering and Computer Science (CECS) follows the traditional selective admission standards of the University of Michigan-Dearborn. Students are admitted directly to CECS as freshmen or as transfer students from other colleges or universities. Admission requirements for entering as a freshman student are described in the Undergraduate Admissions section of this Catalog.

Admission as a Transfer Student

The College of Engineering and Computer Science admits transfer students who have completed course work at a community college or at another four-year school, who have earned a minimum recalculated GPA of 2.75. Also required is a 2.75 recalculated GPA in mathematics courses, relevant science courses, and any engineering or CIS courses completed.

Transfer students can enter at or before the sophomore/junior level, and preparatory work should include completion of Calculus II, and completion of at minimum one science course that counts toward the requirements of the specific degree program. Generally, the mathematics, science, or pre-engineering/pre-computer science programs of other engineering schools, of community colleges, and of liberal arts programs provide an appropriate preparation for admission to the College of Engineering and Computer Science.

Transfer guides (https://umdearborn.edu/cecs/undergraduate-programs/advising/prospective-students) for students interested in transferring into CECS from nearby colleges are available online. Advisors at UM-Dearborn are available to assist prospective students by recommending a specific program of courses at a two-year institution to be taken prior to transfer.

Transfer of Credits

An appraisal of the previous record of a student transferring to the University of Michigan-Dearborn is made at the time of admission to determine the number of credits that apply toward the degree program specified by the applicant. In general, credit will be given for courses taken at accredited institutions in which the student earned at least a C grade and provided that the courses can appropriately be applied as meeting requirements of the student’s chosen degree program. Credit is not transferable for courses in which grades less than C or equivalent was earned in another institution. Irrespective of the number of credits the student has previously earned, a student must complete through instruction from the University of Michigan-Dearborn faculty, a minimum of 30 of the last 36 credits presented for the degree. At least 30 credits must be upper-level course work in their CECS major at the University of Michigan-Dearborn in order to qualify for a University of Michigan-Dearborn degree.

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
• coordination of registration, drops, adds, and total withdrawals
• 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.


**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)

• 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**

• Computer and Information Science (http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/computer-information-science/#minortext)

**Certificates**

• 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**

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

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Varde, Keshav S., PhD, University of Rochester, 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) in order to receive the transcript recognition.

Students in the Computer and Information Science, Cybersecurity and Information Assurance, Data Science, and Software Engineering programs, may use (double count) the cooperative education credit towards fulfilling the basic requirements of their degrees. Students in all other programs in the college may use up to 1 (one) cooperative education credit towards fulfilling the basic requirements of their degree programs.

Students are encouraged to complete a minimum of two full-time work semesters with a participating employer; however, the 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 arranges interviews with appropriate cooperating employers. 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
Each student is formally evaluated by the employer. At the end of the cooperative education assignment (end of semester) the participating student submits a technical report to the faculty member responsible for the cooperative education class.

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 by meeting the pre-requisite courses required for enrolling in the cooperative education 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.

Both the cooperating employers and the University expect that students participating in the Cooperative Education Program will be able to demonstrate a considerable increase in academic knowledge after each term of classroom study. Therefore, participants 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 35 hours of work per week for 12 to 15 consecutive weeks.

In engineering programs, with pre-approval by the engineering academic program faculty, 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 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. In the Computer and Information Science program, the Cybersecurity and Information Assurance program, the Data Science...
program, and the Software Engineering program, both of the cooperative education assignments may be completed for academic credit towards the undergraduate degree program.

Admission to the Cooperative Program

Students who have completed the prerequisite 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 one semester as a full-time student, or 12 credit hours. A GPA of at least 2.30 is a prerequisite to admission into the program.

The courses of this basic requirement 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 requirement 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 prerequisite to the Cooperative Education Program is: Discrete Structures I (CIS 275).
- For students majoring in computer engineering, electrical engineering or robotics engineering, the prerequisites to the Cooperative Education Program are: (1) Circuits (ECE 210) and (2) Digital Systems (ECE 273).
- For students majoring in industrial and systems engineering or manufacturing engineering, the prerequisites 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 prerequisites 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 association with practicing engineers in their daily work. 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. These such registrations are recommended (two are required) for satisfactory completion of the Cooperative Education Program. Since the co-op work assignment occupies the student 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.

CECS Internship Program

The Cooperative Education Office also provides students with internship opportunities. The College of Engineering and Computer Science defines internships as flexible work experiences performed on part-time basis during the academic year and maybe full-time during 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 assignments, Engineering and Computer Science students are paid by their employers for internship assignments. Since internships are part-time employment, they do not require registration in a special internship course. Furthermore, students may enroll full-time while on internship. However, students pursuing an internship are strongly recommended to discuss their overall workload (academic and employment) with an academic advisor in the 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 https://umdearborn.edu/cecs/undergraduate-programs

**Why Apply to the Program**

1. Work on experiential projects that bridge the gap between engineering education and practice.
2. Develop leadership skills.
3. 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 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 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.

**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.