

INDUSTRIAL ENGINEERING, BSE

Industrial & Manufacturing Engineering is an operations and optimization science, focused on productivity, quality and continuous improvement of all business operations from acquisition of raw materials/resources to delivery of finished products/services to customers.

Industrial & Manufacturing Engineering is among the most far-reaching disciplines of engineering. Industrial and Manufacturing Engineers work in diverse industries within both the public and private sectors. Because of the flexibility and value of industrial engineering skills, employment opportunities are numerous and diverse.

Contact ceas-adv@uwm.edu for details.

Accreditation

The Industrial Engineering program is accredited by the Engineering Accreditation Commission of ABET (<https://www.abet.org>).

New Freshmen

Admission to the College of Engineering and Applied Science is based on an overall assessment of both academic and non-academic qualifications. The primary review factors for admission are the strength and quality of the high school curriculum, high school class percentile, grade point average, and the result of the ACT or SAT. Well-prepared freshman applicants will have four years of mathematics (including one-and-a-half years of algebra, one year of geometry, and one-half year of trigonometry) and four years of natural science (including biology, chemistry, and physics). The College also will consider non-academic qualifications such as leadership skills, diversity in personal background, work experience, motivation, and maturity.

Transfer Students

Transfer student admission is based on an overall assessment of both academic and non-academic qualifications. For transfer applicants, the primary factors considered for admission are the grade point average on transferable courses and the level of curriculum completion. The College also will consider non-academic qualifications such as leadership skills, diversity in personal background, work experience, motivation, and maturity.

Applicants who do not meet the requirements for admission to the College of Engineering & Applied Science will automatically be considered for admission to the Pre-Engineering program in the UWM College of General Studies.

The Pre-Engineering program is an Associate degree level program offered jointly by the College of General Studies and the College of Engineering & Applied Science. The curriculum is designed to prepare students for the engineering program with emphasis on mathematics.

Questions on admission to CEAS or choosing a major should be directed to the Office of Student Services, (414) 229-4667.

Industrial Engineering Curriculum

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in industrial engineering is 120.

Code	Title	Credits
Engineering Core - 25 Credits		
IND ENG 111	Introduction to Engineering ¹	3
IND ENG 112	Computer-Aided Design ¹	3
IND ENG 250	Manufacturing Processes ²	3
IND ENG 267	Data Visualization and Analytics	3
IND ENG 285	Project Management	3
IND ENG 360	Engineering Economics	3
COMPSCI 202	Introductory Programming Using Python ³	3
CIV ENG 311	Introduction to Energy, Environment and Sustainability	3
EAS 200	Professional Seminar	1
Major Requirements - 30 credits		
IND ENG 370	Operations Analysis	3
IND ENG 420	Work Standardization and Measurement	3
IND ENG 455	Applied Mathematical Optimization	3
IND ENG 465	Optimization Under Uncertainty	3
IND ENG 475	Computer Simulation	3
IND ENG 540	Foundations of Systems Engineering	3
IND ENG 571	Quality Assurance	3
IND ENG 580	Ergonomics	3
IND ENG 583	Facility Layout and Material Handling	3
IND ENG 595	Capstone Project	3
Mathematics and Natural Science Requirement - 30 credits ⁴		30
<i>Mathematics - At least 17 credits</i>		
Three required math courses:		
MATH 231	Calculus and Analytic Geometry I ⁵	
MATH 232	Calculus and Analytic Geometry II ⁵	
IND ENG 367	Engineering Statistics ⁶	
Plus any two of the following courses:		
COMPSCI 317	Discrete Information Structures	
ELECENG 234	Analytical Methods in Engineering ⁷	
MATH 205	Introductory Finite Mathematics	
MATH 208	Quantitative Models for Business	
MATH 233	Calculus and Analytic Geometry III ⁵	
MATH 240	Matrices and Applications	
<i>Natural Sciences - At least 12 credits</i>		
Two required science courses:		
CHEM 102	General Chemistry	
or CHEM 105	General Chemistry for Engineering	
PHYSICS 209	Physics I (Calculus Treatment)	
Plus one or two of the following courses:		
CHEM 104	General Chemistry and Qualitative Analysis	
PHYSICS 210	Physics II (Calculus Treatment)	
PHYSICS 214	Lab Physics I (Calculus Treatment)	
BIO SCI 100	Animals!	
BIO SCI 101	General Survey of Microbiology	
BIO SCI 102	How Life Works	
BIO SCI 103	Topics in Modern Biology:	
BIO SCI 104	Plants in Today's World	
BIO SCI 150	Foundations of Biological Sciences I	

GEO SCI 100	Introduction to the Earth	
GEO SCI 102	Evolution of the Earth	
GEO SCI 105	Earth, Air, Fire and Water	
GEO SCI 106	The Earth Environment	
GEO SCI 150	Introduction to Ocean Sciences	
GEO SCI 151	Ocean Sciences Laboratory	
Technical Electives - 12 credits		12
Select 12 credits from approved technical electives list below. All non-required IND ENG courses numbered between 400 and 699 are approved technical electives.		
IND ENG 255	Industrial Applications of AI and Machine Learning	
IND ENG 288	Introduction to Spatial Data Science	
IND ENG 290	Elementary Topics in Systems Design:	
IND ENG 390	Senior Thesis	
IND ENG 550	Control of Automated Manufacturing Systems	
IND ENG 555	Manufacturing Systems Integration	
IND ENG 572	Reliability Engineering	
IND ENG 575	Design of Experiments	
IND ENG 582	Ergonomic Job Evaluation Techniques	
IND ENG 587	Lean Production Systems	
IND ENG 588	Global Supply Chain Management	
IND ENG 590	Topics in Industrial and Systems Engineering:	
IND ENG 699	Independent Study	
EAS 1	Engineering Co-op Work Period ⁸	
EAS 497	Study Abroad: ⁹	
MATLENG 201	Engineering Materials	
MATLENG 456	Metal Casting Engineering	
CIV ENG 203	Introduction to Solid Mechanics ¹⁰	
ELECENG 301	Electrical Circuits and Electronics I	
GER Distribution Requirement - 15 credits		
Arts		3
Humanities		3
Social Science		6
ENGLISH 310	Writing, Speaking, and Technoscience in the 21st Century	3
Cultural Diversity - Arts, Humanities, or Social Science course must also satisfy UWM Cultural Diversity Requirement		
Students must also satisfy Oral and Written Communication (OWC) Part A ¹¹		0-6
Students must also satisfy the UWM Foreign Language Requirement ¹¹		0-8
Free Electives - 8 credits		8
Total Credits		120

¹ MECHENG 110 and MECHENG 111 may substitute for IND ENG 111 and IND ENG 112 for transferring students.

² MATLENG 330 may substitute for IND ENG 250 for transferring students.

³ COMPSCI 250 may substitute for COMPSCI 202 for transferring students.

- ⁴ Must include at least 17 credits of mathematics, at least 12 credits of natural science, and at least 1 additional credit of either mathematics or natural science.
- ⁵ MATH 221 and MATH 222 may substitute for MATH 231, MATH 232, and MATH 233.
- ⁶ MTHSTAT 361 may substitute for IND ENG 367 for transferring students.
- ⁷ MATH 234 may substitute for ELECENG 234 for transferring students.
- ⁸ EAS 1 may be retaken for up to 3 credits.
- ⁹ EAS 497 may be retaken for up to 6 credits.
- ¹⁰ CIV ENG 201 or CIV ENG 202 may substitute for CIV ENG 203 for transferring students.
- ¹¹ See General Education Requirements (<https://catalog.uwm.edu/policies/undergraduate-policies/#bachelorsdegreegeneraleducation>) for details.

Industrial Engineering BSE Objectives and Outcomes

Program Educational Objectives

The Industrial Engineering program educational objectives prepare students to:

Objective 1. Graduates have successful careers as professionals in industrial engineering or a related field.

Objective 2. Graduates contribute to improving efficiency, productivity and/or quality of products manufactured, or services provided by their organization.

Objective 3. Graduates demonstrate professionalism and continue their professional development.

Student Outcomes

The BSE program in Industrial Engineering will prepare students to attain:

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- an ability to communicate effectively with a range of audiences.
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Minimum Requirements

Students must maintain an average GPA of at least 2.00 on all work attempted at the University and in all courses offered by the College. Students majoring in biomedical engineering, computer engineering, computer science, industrial engineering, and materials engineering must maintain an average GPA of at least 2.00 in all 300-level and above courses in the student's major department. Students majoring in civil engineering, electrical engineering, and mechanical engineering must maintain an average GPA of at least 2.50 in all 300-level and above courses in the major department. Transferable courses will be included as appropriate. Advancement to major status is required for graduation.

In order to provide maximum flexibility while preserving the institutional identity of a UWM degree, the College requires residence:

1. during the last 30 credits, or
2. during 45 of the last 60 credits, or
3. during any 90 credits of a student's undergraduate career.

At least 15 credits of advanced work in the major must be completed in residence at UWM.

For the Engineering BS program only:

1. complete at least 30 credits at UWM; and
2. complete at least 15 credits in upper-division (numbered 300 or above) courses in the major at UWM.

A student who does not maintain continuous registration during the academic year and is re-admitted to the College must meet the program and graduation requirements in effect at the time of re-entry.

Degree and major requirements must be completed within 10 years of initial enrollment at UW-Milwaukee. Should students not complete the major within the 10-year time frame, the students will switch to the most current degree and major requirements. A new 10-year time frame would then begin.

Dual Majors

Students wishing to major in more than one field can do so in two ways:

1. Complete the requirements for more than one major before receiving a degree from the College. In this case, the degree will list both majors.
2. Be admitted to the College as a second degree candidate (after earning a bachelor's degree in any field), providing University and College entrance requirements are met. Such a student must meet all undergraduate degree requirements in the College and present a minimum of 30 credits beyond the previous bachelor's degree.

Concurrent Registration at Other Institutions

CEAS students wishing to establish concurrent enrollment at another institution must obtain prior permission from their academic advisor.

Student Academic Appeals

Students may appeal an academic action to the Office of Student Services. An appeal is a request for an exception to an established policy or rule. The content of each appeal is carefully reviewed in order to reach a decision. Appeals should be submitted in writing to the

Office of Student Services. The appeals committee considers individual cases concerning the degree requirements and other academic rules and regulations established by the College of Engineering and Applied Science faculty.

The College of Engineering and Applied Science has established written procedures for undergraduate student academic grievances. Copies of the grievance procedure are available in the Office of Student Services. As a first step, students must discuss the grievance with the faculty member or administrator as soon as possible to attempt to resolve the issue, but not later than 30 days after the action that prompted the grievance/appeal.

Computer Science and Engineering Programs

Detailed descriptions of the CEAS undergraduate programs are provided in this catalog. All courses are not offered every semester. A few technical elective courses may be offered only once every three to four semesters. In addition, since computer science and engineering curricula are continually evolving to keep current, students are encouraged to consult with their advisors to plan each semester's list of classes. Part-time students should always maintain a plan that looks ahead two to three semesters to avoid scheduling difficulties.

The curricula outlined in the pages are applicable to new students entering CEAS in fall 2016 or later. Students who enrolled in computer science or engineering programs prior to that date should consult with the appropriate previous editions of this catalog for information about their program requirements. As a general rule, when program changes occur, continuing students have the choice of continuing in their existing program or following the new requirements. Occasionally, a program change will be required of all students regardless of their date of matriculation, so long as it does not increase the total credits needed for graduation.

These program descriptions represent the minimum requirements for graduation from UWM in computer science or engineering. In all cases, it is important that students consult with their advisor before making course selections to avoid errors in programming.

Academic Advising

The Office of Student Services in the College of Engineering and Applied Science, located in Room E386 of the Engineering and Mathematical Sciences Building, offers undergraduate students academic advising from professional advisors who are familiar with the curriculum, College requirements, and the special needs of engineering and computer science students. These advisors provide services such as freshman orientation, course selection, program planning, and credit transfer evaluation. Students are assigned to a permanent professional advisor as soon as they are accepted into the College, and are urged to confer with their advisor at least once each semester. Students also are assigned to a faculty advisor who provides technical expertise specific to the student's area of study.

We understand that it can be a delicate balance managing school, work, family, and active social lives. The College of Engineering and Applied Science advisors are here to help you achieve that balance.

You will be assigned a professional academic advisor upon being admitted to the College of Engineering & Applied Science. Your advisor

will work with you throughout your undergraduate experience, providing guidance on:

- course registration,
- graduation planning,
- career preparation,
- and serving as a liaison to the many other resources available on our campus.

Advisors are also a great source of information on student organizations, tutoring and scholarship opportunities.

In addition to professional academic advisors, you will also have access to faculty advisors. These advisors can provide insights into the technical aspects of the engineering and computer science curricula while mentoring you as you define your professional goals.

Joint Programs with Other Campuses

Pre-engineering

Qualified students may enroll in coordinated pre-engineering programs at UW-Green Bay, UW-Parkside, and UW-Waukesha for two years of pre-engineering coursework. These coordinated programs ensure equivalent coursework, appropriate advising, and early access to the Cooperative Education Program at UWM.

Dual Degree Programs

Qualified students may enroll in coordinated dual degree programs at Alverno College, Carroll University, UW-Eau Claire, UW-Green Bay, UW-La Crosse, UW-Oshkosh, UW-Stevens Point, UW-Whitewater and Wisconsin Lutheran College. Students in these programs will earn a bachelor's degree at both universities in five years. Students transfer to UWM after three years at the partner university. For more information, contact the Office of Student Services at (414) 229-4667.

Joint Programs with Wisconsin Technical Colleges

Gateway Technical College

An agreement with GTC allows those students having associate degrees in the Electrical Engineering - Technology the opportunity to be given credit for courses required in the UWM bachelor of science in engineering program. For more information, contact the Office of Student Services at (414) 229-4667.

Milwaukee Area Technical College

An agreement with MATC allows joint admission and enrollment at MATC and CEAS. Qualified students may take English, mathematics, chemistry, and general education courses at MATC. The program ensures equivalent coursework and appropriate advising. Students complete a bachelor of science degree in engineering or computer science at UWM.

Waukesha County Technical College

An agreement with WCTC allows those students having associate degrees in the Industrial Occupations Division at WCTC the opportunity to be given credit for courses required in the UWM bachelor of science in engineering or bachelor of science in computer science program. For more information, contact the Office of Student Services at (414) 229-4667.

Honors in the Major

Students in Industrial Engineering who meet all of the following criteria can be awarded honors in the major upon graduation:

1. A 3.000 cumulative GPA in all UWM graded credits;
2. A 3.500 GPA over all upper-division (300 level and higher) IND ENG courses;
3. At least one of the following:
 - a. Participation in the Accelerated MS program with successful completion of 6 credits in IND ENG approved courses.
 - b. Successful completion of 3 credits of faculty supervised research (IND ENG 699).
 - c. A- grade or better in IND ENG 595.

College of Engineering and Applied Science Dean's Honor List

GPA of 3.500 or above, earned on a full-time student's GPA on 12 or more graded credits in a given semester.

Honors College Degree and Honors College Degree with Distinction

Granted to graduating seniors who complete Honors College requirements, as listed in the Honors College (<https://catalog.uwm.edu/honors-college/>) section of this site.

Commencement Honors

Students with a cumulative GPA of 3.500 or above, based on a minimum of 40 graded UWM credits earned prior to the final semester, will receive all-university commencement honors and be awarded the traditional gold cord at the December or May Honors Convocation. Please note that for honors calculation, the GPA is **not** rounded and is truncated at the third decimal (e.g., 3.499).

Final Honors

Earned on a minimum of 60 graded UWM credits: Cum Laude - 3.500 or above; Magna Cum Laude - 3.650 or above; Summa Cum Laude - 3.800 or above.