MECHANICAL ENGINEERING, B.S.

Mechanical engineers are problem-solvers who make things work better, more efficiently, and more economically. They are innovators, coming up with original ideas to apply scientific knowledge in new ways. Mechanical engineers are builders, designing and developing machines and systems that make life easier. Mechanical engineers have strong science, mathematics, and technology backgrounds.

Manufacturing processes, design of mechanical equipment and systems, and energy generation and utilization are traditional mechanical engineering fields. Students receive basic preparation in all of these areas. Through choice of elective courses they may further specialize in areas such as automatic control systems, renewable energy systems, robotics, product design, biomedical engineering, computational mechanics, manufacturing systems engineering, etc. Mechanical engineering prepares students for entrance into industry, for independent business (e.g., consulting, contracting, or manufacturing), or for work in government agencies. A degree in mechanical engineering may be used as a background for medicine, law, or business, as well as for graduate work in engineering.

Work in these areas requires a solid background in mathematics, statistics, mechanics, physics, machine design, thermal sciences, materials, the use of computers, and manufacturing processes. Mechanical engineers must also possess good communication skills and be able to work in teams. Mechanical engineers should be aware of social and environmental consequences of their work.

With these skills, broad training, and an emphasis on systems design, mechanical engineers are in demand in practically every type of manufacturing, consulting, sales, and research organization. Mechanical engineers may work in automotive, materials processing, heavy equipment, paper, plastics, power, aerospace, chemical, electronics, or many other large and small industries. Their work may involve research and development of new products, design of equipment or systems, supervision of production, plant engineering, administration, sales engineering, or testing of individual components or complete assemblies.

Although many special areas exist in the profession, mechanical engineering can be subdivided into energy systems and mechanical systems.

The energy systems field has taken on special significance with the current awareness of the limited energy sources and the effects of energy use on the environment. In this field, mechanical engineers carry out work on the behavior of liquids, gases, and solids as they are used in all types of energy-conversion systems. Automotive engines, gas turbines, steam power plants, refrigeration systems, air pollution control, cryogenics and energy utilization require this type of background. To be proficient in this the engineer must have a knowledge of thermodynamics, fluid dynamics, heat transfer, and related subjects.

The mechanical systems field covers the design and manufacturing of products and equipment. Mechanical engineers who focus on design conceive of new devices and machines and also refine and improve existing designs. The design engineer must be proficient in kinematics, machine elements, mechanics, strength and properties of materials, dynamics, vibrations, etc. Mechanical engineers who focus on manufacturing are involved with planning and selecting manufacturing methods, with designing and developing manufacturing equipment, and with increasing the efficiency and productivity of current manufacturing technologies for polymer, metal, and ceramic products. The manufacturing engineer uses chemistry, materials science, mechanics of materials, materials processing principles and practices, principles of computer control, engineering statistics, and other physical and thermal sciences to improve manufacturing operations and systems, and the products they produce. Increasingly, the systems that mechanical engineers work with incorporate biological and information technology components.

MECHANICAL ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES

Graduates from the undergraduate program in mechanical engineering will choose to use the knowledge and skills they have acquired during their undergraduate years to pursue a wide variety of career and life goals. We encourage this diversity of paths.

Independent of whether our graduates choose to pursue a professional career, postgraduate education, or volunteer service in engineering or a different field; we expect that our graduates will achieve the following objectives within three to five years after graduation:

1. They will exhibit a fundamental understanding of broader engineering disciplines with strong skills in mechanical engineering, problem solving, leadership, teamwork, and communication.
2. They will use these skills to contribute to their organizations and communities.
3. They will make thoughtful, well-informed decisions in their career and life.
4. They will demonstrate a continuing commitment to and interest in their own and other's education.

HOW TO GET IN

ADMISSION TO THE COLLEGE AS A FRESHMAN

Students applying to UW–Madison (https://www.admissions.wisc.edu/apply/) need to indicate an engineering major (https://www.engr.wisc.edu/academics/undergraduate-academics/choosing-a-major/) as their first choice in order to be considered for direct admission to the College of Engineering. Direct admission to a major means students will start in the program of their choice in the College of Engineering and will need to meet progression requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/first-year-undergraduate-students/progression-requirements/) at the end of the first year to guarantee advancement in that program.

CROSS-CAMPUS TRANSFER TO ENGINEERING

UW–Madison students in other schools and colleges on campus must meet the course and credit requirements for admission to engineering degree granting classifications specified in the general college requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/cross-campus-students/). The requirements are the minimum for admission consideration. Cross-campus admission is competitive and selective, and the grade point average expectations may increase as demand trends change. The student's overall academic record at UW–Madison is also considered. Students apply to their intended engineering program by submitting the online application by stated deadlines for spring and fall. The College of Engineering

offers an online information tutorial and drop-in advising (https://www.engr.wisc.edu/academics/student-services/academic-advising/cross-campus-students/) for students to learn about the cross-campus transfer process.

OFF-CAMPUS TRANSFER TO ENGINEERING

With careful planning, students at other accredited institutions can transfer coursework that will apply toward engineering degree requirements at UW–Madison. Off-campus transfer applicants are considered for direct admission to the College of Engineering by applying to the Office of Admissions with an engineering major listed as their first choice. Those who are admitted to their intended engineering program must meet progression requirements (https://www.engr.wisc.edu/academics/student-services/academic-advising/transfer-students/) at the point of transfer or within their first two semesters at UW–Madison to guarantee advancement in that program. A minimum of 30 credits in residence in the College of Engineering is required after transferring, and all students must meet all requirements for their major in the college. Transfer admission to the College of Engineering is competitive and selective, and students who have earned more than 80 transferable semester credits at the time of application are not eligible to apply.

The College of Engineering has dual degree programs with select four-year UW System campuses. Eligible dual degree applicants are not subject to the 80 credit limit.

Off-campus transfer students are encouraged to discuss their interests, academic background, and admission options with the Transfer Coordinator in the College of Engineering: ugtransfer@engr.wisc.edu or 608-262-2473.

SECOND BACHELOR'S DEGREE

The College of Engineering does not accept second undergraduate degree applications. Second degree students (https://www.engr.wisc.edu/admissions/undergraduate-admissions/returning-adults-second-degree-students/) might explore the Biological Systems Engineering program at UW–Madison, an undergraduate engineering degree elsewhere, or a graduate program in the College of Engineering.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the *Guide*.

General Education
- Breadth—Humanities/Literature/Arts: 6 credits
- Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits
- Breadth—Social Studies: 3 credits
- Communication Part A & Part B *
- Ethnic Studies *
- Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

SUMMARY OF REQUIREMENTS

The following curriculum applies to undergraduate students admitted to the Mechanical Engineering degree program in Fall 2021 or later. Check with the department for any recent changes. Students admitted before Fall 2021 can locate their curriculum at this link (https://www.engr.wisc.edu/department/mechanical-engineering/academics/bachelor-of-science-in-mechanical-engineering/).

Code	Title	Credits
Mathematics and Statistics		19
Basic Science		14
Non–Mechanical Engineering		12
Mechanical Engineering Core		50
Technical Electives		9
Math/Science Electives		3
Communication Skills		6
Liberal Studies		15
Total Credits		**128**

MATHEMATICS/STATISTICS

Code	Title	Credits
MATH 221	Calculus and Analytic Geometry 1	5
MATH 222	Calculus and Analytic Geometry 2	4
MATH 234	Calculus--Functions of Several Variables	4
MATH 320	Linear Algebra and Differential Equations	3
STAT 324	Introductory Applied Statistics for Engineers	3
Total Credits		**19**

All transfer students must have the equivalent of the above courses. If the above requirement is fulfilled with fewer than 19 credits, the balance becomes free elective credits.
Transfer students may fulfill the statistics requirement with other statistics courses having a calculus prerequisite and the approval of the mechanical engineering department via a Course Substitution Form.

BASIC SCIENCE

Code	Title	Credits
Select one of the following:		4-5
CHEM 109	Advanced General Chemistry	

CHEM 103	General Chemistry I	
COMP SCI 220	Data Science Programming I	4
PHYSICS 202	General Physics [1]	5
Total Credits		**13-14**

[1] Students following the normal M E course sequence need not take PHYSICS 201 General Physics to satisfy the prerequisites for PHYSICS 202 General Physics.

NON-MECHANICAL ENGINEERING

Code	Title	Credits
E M A 201	Statics (with a grade of C or better)	3
M S & E 350	Introduction to Materials Science	3
E C E 376	Electrical and Electronic Circuits	3
E C E 377	Fundamentals of Electrical and Electro-mechanical Power Conversion	3
or M E 346	Introduction to Feedback Control for Mechanical Engineers	
Total Credits		**12**

MECHANICAL ENGINEERING CORE

Code	Title	Credits
M E 201	Introduction to Mechanical Engineering	3
M E 231	Geometric Modeling for Design and Manufacturing	3
M E 240	Dynamics (with a grade of C or better)	3
M E 306	Mechanics of Materials (with a grade of C or better)	3
M E/E M A 307	Mechanics of Materials Lab	1
Choose one sequence:		6
M E 310 & M E 311	Manufacturing: Polymer Processing and Engineering and Manufacturing: Metals and Automation	
M E 313 & M E 314	Manufacturing Processes and Manufacturing Fundamentals	
M E 331	Computer-Aided Engineering	3
M E 340	Dynamic Systems	3
M E 342	Design of Machine Elements	3
M E 351 & M E 352	Interdisciplinary Experiential Design Projects I and Interdisciplinary Experiential Design Projects II	6
M E 361	Thermodynamics (with a grade of C or better)	3
M E 363	Fluid Dynamics	3
M E 364	Elementary Heat Transfer	3
M E 368	Engineering Measurements and Instrumentation	4
M E 370	Energy Systems Laboratory	3
Total Credits		**50**

TECHNICAL ELECTIVES

Code	Title	Credits
The mechanical engineering curriculum requires a total of 9 credits of technical electives. A minimum of 3 of those 9 credits must be from formal M E courses numbered 400 and higher. A formal course is defined as a class that meets regularly in a lecture format to study a selected topic. The educational mission is assisted with homework and exams. Formal courses include online courses but do not include seminar, survey, independent study, research, topics, or similar courses.		9
Technical electives include formal courses in engineering, mathematics, physics, chemistry, statistics, and computer science courses numbered 400 and higher. INTEREGR and E P D courses are limited to those listed below. The following courses are also accepted as technical electives:		
ANAT&PHY 335	Physiology	5
BMOLCHEM 314	Introduction to Human Biochemistry	3
BSE 351	Structural Design for Agricultural Facilities	3
BSE 364	Engineering Properties of Food and Biological Materials	3
BSE/ENVIR ST 367	Renewable Energy Systems	3
CBE 320	Introductory Transport Phenomena	4
CBE 326	Momentum and Heat Transfer Operations	3
CHEM 341	Elementary Organic Chemistry	3
CHEM 343	Introductory Organic Chemistry	3
CHEM 345	Intermediate Organic Chemistry	3
CIV ENGR 311	Hydroscience	3
CIV ENGR 320	Environmental Engineering	3
CIV ENGR/G L E 330	Soil Mechanics	3
CIV ENGR 340	Structural Analysis I	3
CIV ENGR 370	Transportation Engineering	3
CIV ENGR 392	Building Information Modeling (BIM)	3
CIV ENGR 415	Hydrology	3
COMP SCI 300	Programming II	3
COMP SCI 320	Data Science Programming II	4
COMP SCI/E C E 354	Machine Organization and Programming	3
E C E 320	Electrodynamics II	3
E C E 330	Signals and Systems	3
E C E 340	Electronic Circuits I	3
E C E 342	Electronic Circuits II	3
E C E/COMP SCI 352	Digital System Fundamentals	3
E C E 353	Introduction to Microprocessor Systems	3
E C E/COMP SCI 354	Machine Organization and Programming	3
E C E 355	Electromechanical Energy Conversion	3
E C E 356	Electric Power Processing for Alternative Energy Systems	3

E P 272	Engineering Problem Solving Using Maple	1
E P D 374		3
E P D 375		3
E P D 660	Core Competencies of Sustainability	3
INTEREGR 301	Engineering and Biology: Technological Symbiosis	1-4
I SY E 315	Production Planning and Control	3
I SY E 323	Operations Research-Deterministic Modeling	3
I SY E/PSYCH 349	Introduction to Human Factors	3
INFO SYS 371	Technology of Computer-Based Business Systems	3
MATH 321	Applied Mathematical Analysis	3
MATH 322	Applied Mathematical Analysis	3
M E 273	Engineering Problem Solving with EES	1
M S & E 330	Thermodynamics of Materials	4
M S & E 332	Macroprocessing of Materials	3
M S & E 352	Materials Science-Transformation of Solids	3
N E 305	Fundamentals of Nuclear Engineering	3
PHYSICS 205	Modern Physics for Engineers	3
PHYSICS 241	Introduction to Modern Physics	3
PHYSICS 311	Mechanics	3
PHYSICS 321	Electric Circuits and Electronics	4
PHYSICS 322	Electromagnetic Fields	3
PHYSICS 325	Optics	4
STAT 311	Introduction to Theory and Methods of Mathematical Statistics I	3
STAT 312	Introduction to Theory and Methods of Mathematical Statistics II	3
STAT 333	Applied Regression Analysis	3
STAT 349	Introduction to Time Series	3
STAT 351	Introductory Nonparametric Statistics	3

Up to 3 technical elective credits may be obtained for non-formal courses such as independent study courses (M E 489, M E 491, M E 492, and other engineering independent study courses numbered 399 and higher); Cooperative Education (M E 1); and E P D 690, "Wisconsin Engineer Magazine."

MATH/SCIENCE ELECTIVES

Code	Title	Credits
The mechanical engineering curriculum requires 3 credits of math/science electives. CHEM 104 and any formal course listed as a biological science and numbered 100 or higher will satisfy this requirement. In addition, any formal course offered by an engineering department, or listed as a physical or natural science, and numbered 200 or higher, will also satisfy this requirement. INTEREGR and E P D courses will not satisfy the math/science elective requirement.		3
Total Credits		**3**

COMMUNICATION SKILLS

Code	Title	Credits
ENGL 100	Introduction to College Composition	3
or LSC 100	Science and Storytelling	
or COM ARTS 100	Introduction to Speech Composition	
or ESL 118	Academic Writing II	
INTEREGR 397	Engineering Communication (was EPD 397 before Fall 2020)	3
Total Credits		**6**

LIBERAL ELECTIVES

Code	Title	Credits
The Mechanical Engineering curriculum requires 15 credits of liberal elective courses. See College of Engineering Liberal Studies Requirements for details.		
Complete Requirements (http://guide.wisc.edu/undergraduate/engineering/#requirementstext)		15
Total Credits		**15**

ADDITIONAL INFORMATION

Students fulfilling all course requirements with fewer than 128 credits must comply with the credit minimum by taking additional free elective credits. Students in good standing may take free elective courses pass/fail (see the College of Engineering Official Regulations (http://guide.wisc.edu/undergraduate/engineering/#policiesandregulationstext) for details). Pass/fail courses do not count toward specific degree requirements.

Independent Studies and projects courses:

Code	Title	Credits
M E 291	Undergraduate Mechanical Engineering Projects	1-3
M E 299	Independent Study	1-3
M E 489	Honors in Research	1-3
M E 491	Mechanical Engineering Projects I	1-3
M E 492	Mechanical Engineering Projects II	1-3

Students must have a cumulative 2.5 GPA or a 3.0 GPA for their previous two semesters and have written permission to enroll from their research advisor.

For information on credit loads, adding or dropping courses, course substitutions, pass/fail, auditing courses, dean's honor list, repeating courses, probation, and graduation, see the College of Engineering

Official Regulations (http://guide.wisc.edu/undergraduate/engineering/#policiesandregulationstext).

UNIVERSITY DEGREE REQUIREMENTS

Total Degree	To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.
Residency	Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. “In residence” credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.
Quality of Work	Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.

LEARNING OUTCOMES

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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
3. an ability to communicate effectively with a range of audiences
4. 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
5. 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
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

First Year

Fall	Credits	Spring	Credits
MATH 221	5	MATH 222	4
CHEM 109 or 103[1]	5	E M A 201[2]	3
M E 201	3	M E 231	3
Liberal Studies Elective	3	Communication A	3
	3	Liberal Studies Elective	3
	16		**16**

Second Year

Fall	Credits	Spring	Credits
MATH 234	4	MATH 320	3
M E 306[2]	3	M E 240[2]	3
M E/E M A 307	1	Math/Science Elective	3
COMP SCI 220	4	M S & E 350	3
Liberal Studies Elective	3	STAT 324	3
	15		**15**

Third Year

Fall	Credits	Spring	Credits
M E 331	3	M E 342	3
M E 361[2]	3	M E 363	3
M E 340	3	INTEREGR 397 (was EPD 397)	3
PHYSICS 202	5	E C E 376	3
M E 310	3	M E 311	3
		Liberal Studies Elective	3
	17		**18**

Fourth Year

Fall	Credits	Spring	Credits
M E 351	3	M E 352	3
M E 364	3	M E 370	3
M E 368	4	Technical Elective	3
M E 346 or E C E 377	3	Technical Elective	3
Technical Elective	3	Liberal Studies Elective	3
	16		**15**

Total Credits 128

1 CHEM 109 Advanced General Chemistry may be taken in place of CHEM 103 General Chemistry I. If CHEM 103 is taken, students may need to take additional free electives to meet the minimum number of credits required for the degree.

2 E M A 201 Statics, M E 240 Dynamics, M E 306 Mechanics of Materials, and M E 361 Thermodynamics each require a minimum grade of C.

ADVISING AND CAREERS

ADVISING

Each College of Engineering program has academic advisors dedicated to serving its students. Program advisors can help current College of Engineering students with questions about accessing courses, navigating degree requirements, resolving academic issues and more. Students can find their assigned advisor on the homepage of their student center.

ENGINEERING CAREER SERVICES

Engineering Career Services (ECS) assists students in identifying pre-professional work-based learning experiences such as co-ops and summer internships, considering and applying to graduate or professional school, and finding full-time professional employment during their graduation year.

ECS offers two major career fairs per year, assists with resume writing and interviewing skills, hosts workshops on the job search, and meets one-on-one with students to discuss offer negotiations.

Students are encouraged to utilize the ECS office early in their academic careers. For comprehensive information on ECS programs and workshops, see the ECS website or call 608-262-3471.

PEOPLE

PROFESSORS

Darryl Thelen (Chair)
Christian Franck
Jaal Ghandhi
Dan Negrut
Gregory F. Nellis
Tim Osswald
Frank Pfefferkorn
John Pfotenhauer
Xiaoping Qian
Douglas Reindl
David Rothamer
Scott T. Sanders
Krishnan Suresh
Lih-sheng Turng

ASSOCIATE PROFESSORS

Peter Adamczyk
Mark Anderson
Melih Eriten
Katherine Fu
Sage Kokjohn
Tom N. Krupenkin
Franklin Miller
Sangkee Min
Mario F. Trujillo
Michael Zinn

ASSISTANT PROFESSORS

Joseph Andrews
Lianyi Chen
Corinne Henak
Wenxiao Pan
Pavana Prabhakar
Alejandro Roldan-Alzate
Josh Roth
Shiva Rudraraju
Stephan Rudykh
Dakota Thompson
Mike Wagner
Michael Wehner
Xiangru Xu

See also Mechanical Engineering Faculty Directory (https://directory.engr.wisc.edu/me/faculty/).

ACCREDITATION

Accreditation.

Accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (http://www.abet.org/).

Note: Undergraduate Program Educational Objectives and Student Outcomes are made publicly available at the Departmental website. (In this Guide, the program's Student Outcomes are designated by our campus as "Learning Outcomes.")