MATERIALS SCIENCE AND ENGINEERING, BS

Students who aspire to discover new materials that will improve our quality of life, work with chemistry, physics and engineering principles, and learn in a hands-on environment with faculty will thrive in the Department of Materials Science and Engineering. Students in MS&E are pioneers, making materials better through innovation. In MS&E, students aren't just hearing about revolutionary materials — They are the ones making them stronger, faster, lighter, smaller and better.

These materials make the world more equitable, reliable and sustainable, improving fuel efficient vehicles, jet engine performance, integrated circuits, green energy, electronics and more. Impacting these areas is possible with advanced tools and technology. Atomic resolution microscopes, analytical instruments, computer-based modeling and data science support MS&E's laboratory coursework and research.

Course structure and camaraderie are other factors that set MS&E apart. Instead of teaching from large lecture halls, MS&E prioritizes small class sizes and hands-on laboratories. Doing so establishes a culture where students are more than a number, where faculty know each of them by name. This tight-knit feel fuels results.

Earning a Bachelors of Science in Materials Science and Engineering opens doors. MS&E graduates have a 95% job placement rate, taking on a variety of roles. Aerospace engineer, analytical chemist, design engineer, research scientist and quality manager are just a few titles that MS&E graduates hold. Working for companies across the globe, MS&E graduates continue carrying out the Wisconsin Idea far beyond Madison.

The department is happy to welcome students who are interested in MS&E's principles, coursework, and impact areas. Additional questions about the undergraduate program can be directed toward MS&E's Associate Chair of Undergraduate Studies Mike Arnold (michael.arnold@wisc.edu). (https://guide.wisc.edu/undergraduate/engineering/materials-science-engineering/materials-science-engineering-bs/michael.arnold@wisc.edu)

HOW TO GET IN

HOW TO GET IN

ADMISSION TO THE COLLEGE AS A FIRST-YEAR STUDENT

Students applying to UW–Madison (https://www.admissions.wisc.edu/apply/) need to indicate an engineering major (https://engineering.wisc.edu/degrees-programs/undergraduate/) as their first choice in order to be considered for direct admission to the College of Engineering. Direct admission means that students get to start their college career in the engineering program of their choice and have access to engineering-specific resources and facilities. Students who are directly admitted need to meet progression requirements (https://engineering.wisc.edu/student-services/undergraduate-student-advising/progression/) 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 minimum admission requirements (https://engineering.wisc.edu/admissions/undergraduate/cross-campus-students/) for admission consideration to engineering degree programs. Cross-campus admission is competitive and selective, and academic performance 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 advising (https://engineering.wisc.edu/admissions/undergraduate/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://engineering.wisc.edu/admissions/undergraduate/transfer-from-off-campus/) 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 engineering major. Transfer admission to the College of Engineering is competitive and selective, and students who have exceeded the 80 credit limit 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 & Academic Program Manager 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 student (https://engineering.wisc.edu/admissions/undergraduate/adult-students-second-degree-students/)s (https://engineering.wisc.edu/student-services/undergraduate-student-advising/) 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 (https://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 students admitted to the materials science and engineering degree program.

Code	Title	Credits
Mathematics and Statistics		19
General Science and Engineering Foundations		26-27
MS&E Required Courses		45
Materials Emphasis Elective Requirements		12
Communication Skills		6
Liberal Studies		16
Free Electives		3-4
Total Credits		**128**

MATHEMATICS AND STATISTICS

Code	Title	Credits
MATH 221	Calculus and Analytic Geometry 1	5
or MATH 217	Calculus with Algebra and Trigonometry II	
MATH 222	Calculus and Analytic Geometry 2	4
MATH 234	Calculus--Functions of Several Variables	4
MATH 319	Techniques in Ordinary Differential Equations	3
or MATH 320	Linear Algebra and Differential Equations	
STAT 324	Introduction to Statistics for Science and Engineering	3
Total Credits		**19**

GENERAL SCIENCE AND ENGINEERING FOUNDATIONS

Code	Title	Credits
General Science		
Physics		
PHYSICS 201	General Physics	5
or PHYSICS 207	General Physics	
or PHYSICS 247	A Modern Introduction to Physics	
PHYSICS 202	General Physics	5
or PHYSICS 208	General Physics	
or PHYSICS 248	A Modern Introduction to Physics	
Chemistry		
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	5
or CHEM 109	Advanced General Chemistry	
CHEM 343	Organic Chemistry I	3
or CHEM 341	Elementary Organic Chemistry	
Science Elective		
Select one of the following:		3
CHEM 311	Chemistry Across the Periodic Table	
CHEM 327	Fundamentals of Analytical Science	
CHEM 329	Fundamentals of Analytical Science	
CHEM 345	Organic Chemistry II	
PHYSICS 205	Modern Physics for Engineers	
PHYSICS/ E C E 235	Introduction to Solid State Electronics	
PHYSICS 241	Introduction to Modern Physics	
ZOOLOGY/ BIOLOGY 101	Animal Biology	
ZOOLOGY/ BIOLOGY/ BOTANY 151	Introductory Biology	
ZOOLOGY 153	Introductory Biology	
Engineering Foundation		
Introduction to Engineering		
M S & E 260	Materials Experience (or another CoE Intro to Engineering course)	2
Computer Sciences		
Select one of the following (COMP SCI 220 preferred):		3-4
COMP SCI 220	Data Science Programming I	
COMP SCI 200	Programming I	
COMP SCI 300	Programming II	
COMP SCI 320	Data Science Programming II	
COMP SCI 400	Programming III	
Total Credits		**26-27**

MATERIALS SCIENCE AND ENGINEERING REQUIRED COURSES

Code	Title	Credits
M S & E 330	Thermodynamics of Materials	4
M S & E 331	Transport Phenomena in Materials	3
M S & E 332	Macroprocessing of Materials	3
M S & E 333	Microprocessing of Materials	3
M S & E 351	Materials Science-Structure and Property Relations in Solids	3
M S & E 352	Materials Science-Transformation of Solids	3
M S & E 360	Structures & Phases Lab	2
M S & E 361	Kinetics & Thermodynamics Lab	2
M S & E 362	Synthesis & Characterization Lab	3

M S & E/CHEM 421	Polymeric Materials	3
M S & E 441	Deformation of Solids	3
M S & E 451	Introduction to Ceramic Materials	3
M S & E 456	Electronic, Optical, and Magnetic Properties of Materials	3
M S & E 460	Introduction to Computational Materials Science and Engineering	3
M S & E 470	Capstone Project I	1
M S & E 471	Capstone Project II	3
Total Credits		**45**

MATERIALS SCIENCE AND ENGINEERING EMPHASIS ELECTIVES

Code	Title	Credits
Select 6 credits from: M S & E courses numbered 400 or above, B M E/PHM SCI 430, M E 417, M E 418, or M E 419 [1]		6
Select 6 credits of select engineering, science and math/statistics coursework in consultation with an M S & E faculty advisor [2]		6
Total Credits		**12**

[1] M S & E 699 Independent Study cannot be used to fulfill this requirement.

[2] Select 6 credits of coursework from M S & E courses numbered 400 or above, other engineering, Biochemistry, Chemistry, Computer Sciences, Math, Physics, Statistics, or Zoology courses numbered 300 or above, or up to 3 credits of combined M S & E 1 Cooperative Education Program and/or M S & E 699 Independent Study research credit (or from another engineering department). M S & E advisor approval of the set of selections is required. Course sets may be broad-based or concentrated in a subfield of materials science and engineering.

COMMUNICATION SKILLS

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

LIBERAL STUDIES

Complete 16 credits of liberal studies requirements (https://guide.wisc.edu/undergraduate/engineering/#requirementstext).

- Students must take 16 credits that carry H, S, L, or Z breadth designators. These credits must fulfill the following sub-requirements:

1. A minimum of two courses from the same subject area (https://registrar.wisc.edu/subjectareas/) (the description before the course number). At least one of these two courses must be designated as above the elementary level (I, A, or D).
2. A minimum of 6 credits designated as humanities (H, L, or Z in the course listing), and an additional minimum of 3 credits designated as social science (S or Z in the course listing). Foreign language courses count as H credits. Retroactive credits for language courses may not be used to meet the Liberal Studies credit requirement (they can be used for sub-requirement 1 above).
3. At least 3 credits in courses designated as ethnic studies (lower case "e" in the course listing). These courses may help satisfy sub-requirements 1 and 2 above, but they count only once toward the total required. Note: Some courses may have "e" designation but not have H, S, L, or Z designation; these courses do not count toward the Liberal Studies requirement.

FREE ELECTIVES

Select 3-4 elective credits.

- The above subject requirements can be met with 123 credits of UW courses. Students must complete 128 credits of coursework to earn the B.S. in materials science and engineering. The 3-4 elective credits may be earned by choosing elective courses that carry more credits than the requirement's minimum credit load or by taking any additional coursework of the student's choice.

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

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

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

First Year

Fall	Credits	Spring	Credits
MATH 221	5	MATH 222	4
CHEM 109	5	PHYSICS 201, 207, or 247	5
M S & E 260	2	Science Elective	3
Communications A	3	Liberal Studies Elective	3
Liberal Studies Elective	3		
	18		**15**

Second Year

Fall	Credits	Spring	Credits
MATH 234	4	MATH 319 or 320	3
Computer Science Elective	3	PHYSICS 202, 208, or 248	5
M S & E 330	4	M S & E 352	3
M S & E 351	3	M S & E 361	2
M S & E 360	2	Liberal Studies Elective	3
	16		**16**

Third Year

Fall	Credits	Spring	Credits
CHEM 341 or 343	3	M S & E 331	3
M S & E 332	3	M S & E 333	3
M S & E 362	3	STAT 324	3
M S & E 451	3	Materials Emphasis Elective	3
Liberal Studies Elective	3	Liberal Studies Elective	4
Free Elective	1		
	16		**16**

Fourth Year

Fall	Credits	Spring	Credits
M S & E 456	3	M S & E 471	3
M S & E 470	1	M S & E 441	3
M S & E/CHEM 421	3	M S & E 460	3
Tech Emphasis Elective	3	Materials Emphasis Elective	3
Tech Emphasis Elective	3	INTEREGR 397	3
Free Elective	3		
	16		**15**

Total Credits 128

ADVISING AND CAREERS

ADVISING AND CAREERS

ADVISING

Every College of Engineering undergraduate has an assigned academic advisor (https://engineering.wisc.edu/student-services/undergraduate-student-advising/). Academic advisors support and coach students through their transition to college and their academic program all the way through graduation.

Advisors help students navigate the highly structured engineering curricula and course sequencing, working with them to select courses each semester.

When facing a challenge or making a plan toward a goal, students can start with their academic advisor. There are many outstanding resources at UW–Madison, and academic advisors are trained to help students navigate these resources. Advisors not only inform students about the various resources, but they help reduce the barriers between students and campus resources to help students feel empowered to pursue their goals and communicate their needs.

Students can find their assigned advisor in their MyUW Student Center.

ENGINEERING CAREER SERVICES

Engineering Career Services (https://ecs.wisc.edu) (ECS) assists students in finding work-based learning experiences such as co-ops and summer internships, exploring and applying to graduate or professional school, and finding full-time professional employment.

ECS offers two large career fairs per year, assists students with resume building and developing interviewing skills, hosts skill-building workshops, and meets one-on-one with students to discuss offer negotiations.

Students are encouraged to engage with the ECS office early in their academic careers. For more information on ECS programs and workshops, visit: https://ecs.wisc.edu.

ACCREDITATION

ACCREDITATION

Accredited by the Engineering Accreditation Commission of ABET (https://www.abet.org/), https://www.abet.org, under the commission's General Criteria and Program Criteria for Materials (1), Metallurgical (2), Ceramics (3), and Similarly Named Engineering Programs.

PROGRAM EDUCATIONAL OBJECTIVES FOR THE BACHELOR OF SCIENCE IN MATERIALS SCIENCE AND ENGINEERING

We recognize that our graduates will choose to use the knowledge and skills that they have acquired during their undergraduate years to pursue a wide variety of career and life goals, and we encourage this diversity of paths. Whatever path our graduates may choose, we expect them to be meeting the following objectives at least three to five years after graduation:

1. Skills and Tools. Graduates will be applying the tools and skills acquired during their undergraduate experience either in post-graduate educational programs or as employees in materials-related industries.

2. Early Career Growth. Graduates will have experienced professional growth in their chosen post-baccalaureate pursuits, for example, through acquisition of advanced degrees or advancement in employment rank.
3. Professional Citizenship. Graduates will have demonstrated awareness of contemporary issues in technology and society and ethical responsibility.
4. Life-Long Learning: Graduates will have demonstrated a continuing commitment to learning.

Note: Undergraduate Student Outcomes, number of degrees conferred, and enrollment data are made publicly available at the Materials Science and Engineering Undergraduate Program website (https://engineering.wisc.edu/programs/degrees/materials-science-and-engineering-bs/). (In this Guide, the program's Student Outcomes are available through the "Learning Outcomes" tab.)