

# MECHANICAL ENGINEERING, M.S.

The Department of Mechanical Engineering offers master of science (M.S.) degrees in Mechanical Engineering with a thesis option or a course option. The thesis option and course option M.S. degrees take approximately two years to complete. The thesis option has a significant research component giving students valuable hands on research experience with mentoring by faculty in the Department of Mechanical Engineering. The course-option M.S. degree has a stronger focus on coursework but also requires at least 3 credits of independent study mentored by faculty in the Department of Mechanical Engineering. For either option students are mentored by the world-class faculty in the mechanical engineering department at UW–Madison.

For a list of mechanical engineering faculty along with faculty research interests, please visit our faculty directory (<https://directory.engr.wisc.edu/display.php/faculty?page=me&search=faculty>). For more information on research areas see our page on research in Mechanical Engineering (<https://www.engr.wisc.edu/department/mechanical-engineering/research-in-mechanical-engineering>).

## ADMISSIONS

Students with a strong background in mechanical engineering or a related field with interest in furthering their education in mechanical engineering are encouraged to apply for admission to the department. Applicants accepted into the program generally have an undergraduate grade point average well above the graduate school minimum of 3.0 on a 4.0 scale. All applicants are required to take the Graduate Record Exam (GRE). Applications are evaluated on the basis of previous academic record, GRE scores, letters of recommendation, and a personal statement. For more information on admission requirements see the department's MS degree website (<https://www.engr.wisc.edu/department/mechanical-engineering/academics/masters-degree-mechanical-engineering-2-2>).

### APPLICATION DEADLINE: JANUARY 1

Applications are accepted for admission during the fall semester.

## GRADUATE SCHOOL ADMISSIONS

Graduate admissions is a two-step process between academic degree programs and the Graduate School. Applicants must meet requirements of both the program(s) and the Graduate School. Once you have researched the graduate program(s) you are interested in, apply online (<https://grad.wisc.edu/admissions>).

## FUNDING

### GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (<https://grad.wisc.edu/funding>) is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

## PROGRAM RESOURCES

There are three mechanisms for Graduate Student funding through the university for Mechanical Engineering M.S. students:

1. Fellowships
2. Graduate assistantships: project assistantships, teaching assistantships, and research assistantships
3. Traineeships

Funding is awarded based on the qualifications of the student, the number of applicants, the amount of available funding, and the number of continuing students receiving support. Fellowship and research assistantship funding is only considered for thesis-based M.S. students. You can apply for funding for research assistantships by contacting individual faculty members directly. Please check our website (<http://directory.engr.wisc.edu/me/faculty>) to look for faculty (only those listed with titles of assistant professor, associate professor, or professor can serve as graduate student advisors). Search for faculty who have research interests that align closely with your own by viewing faculty directory entries, visiting the faculty's website (linked from the directory page), and reviewing publications by the faculty member. Once you have identified faculty with interests close to your own, you are encouraged to contact them by email to inquire regarding available research assistant positions. The admissions office does not know if a particular professor has research assistant positions available.

Students who apply to the department will be automatically considered for fellowship opportunities within the department. For information on applying for teaching assistant positions and for other information on funding please see the department website (<https://www.engr.wisc.edu/department/mechanical-engineering/academics/phd-in-mechanical-engineering>).

## REQUIREMENTS

### MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (<http://guide.wisc.edu/graduate/#policiesandrequirements>), in addition to the program requirements listed below.

### MAJOR REQUIREMENTS

#### MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	No

#### Mode of Instruction Definitions

**Evening/Weekend:** These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.

**Online:** These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich,

interactive learning environment. For more information about the online nature of a specific program, contact the program.

**Hybrid:** These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

**Accelerated:** These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

## CURRICULAR REQUIREMENTS

Minimum Credit Requirement	30 credits
Minimum Residence Credit Requirement	Thesis track: 21 credits. Course track: 18 credits.
Minimum Graduate Coursework Requirement	Half of degree coursework (15 out of 30 total credits) must be in graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university's Course Guide ( <a href="http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle">http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle</a> ).
Overall Graduate GPA Requirement	3.00 GPA required.
Other Grade Requirements	Students must earn a C or above in all formal coursework. Students may not have any more than two Incompletes on their record at any one time.
Assessments and Examinations	The thesis track requires that the student pass a formal thesis defense.
Language Requirements	No language requirements.

## REQUIRED COURSES

For both the thesis or course track<sup>1</sup>, two semesters of M E 903 Graduate Seminar are required. These should be taken the first two semester the student is in residence.

Thesis-track requirements: a minimum of 18 formal course credits (minimum of 9 formal course credits in ME taken at UW–Madison); one of these courses must be numbered 700 or higher, and a minimum of 9 thesis credits (M E 790 Master's Research and Thesis).

Course-track requirements: a minimum of 24 formal course credits (minimum of 15 formal course credits in ME taken at UW–Madison); one of these courses must be numbered 700 or higher, and a minimum of 3 thesis credits of independent study (M E 699 Advanced Independent Study).

<sup>1</sup> These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

## Courses Numbered 400 and above in M E which count toward course, independent study, research credit requirements:

Code	Title	Credits
M E/B M E 415	Biomechanics of Human Movement	3
M E 417	Transport Phenomena in Polymer Processing	3
M E 418	Engineering Design with Polymers	3
M E 419	Fundamentals of Injection Molding	3
M E 420	Introduction to Polymer Composites Processing	3
M E/STAT 424	Statistical Experimental Design	3
M E/CBE/CHEM/ E M A 425	Undergraduate Rheology Seminar	1
M E 429	Metal Cutting	3
M E/M S & E 435	Joining of Materials: Structural, Electronic, Bio and Nano Materials	3
M E 437	Advanced Materials Selection	3
M E/E C E 439	Introduction to Robotics	3
M E 440	Intermediate Vibrations	3
M E/BSE/ FOOD SCI 441	Rheology of Foods and Biomaterials	3
M E 444	Design Problems in Elasticity	3
M E 445	Mechatronics in Control & Product Realization	3
M E 446	Automatic Controls	3
M E 447	Computer Control of Machines and Processes	3
M E 448	Mechanical Systems Analysis	3
M E 449	Redesign and Prototype Fabrication	3
M E 450	Design and Dynamics of Vehicles	3
M E 451	Kinematics and Dynamics of Machine Systems	3
M E 460	Applied Thermal / Structural Finite Element Analysis	3
M E 461	Thermal Systems Modeling	3
M E/M S & E 462	Welding Metallurgy	3
M E 466	Air Pollution Effects, Measurements and Control	3
M E 469	Internal Combustion Engines	3
M E/BSE 475	Engineering Principles of Agricultural Machinery	3
M E/BSE 476	Engineering Principles of Off-Road Vehicles	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
M E/CIV ENGR/ E M A 508	Composite Materials	3
M E/I SY E 510	Facilities Planning	3
M E/I SY E 512	Inspection, Quality Control and Reliability	3
M E/I SY E 513	Analysis of Capital Investments	3
M E 514	Additive Manufacturing	3
M E/N E 520	Two-Phase Flow and Heat Transfer	3
M E/CBE 525	Macromolecular Hydrodynamics	3

M E/COMP SCI/ E C E 532	Matrix Methods in Machine Learning	3	M E 764	Advanced Heat Transfer I- Conduction	3
M E 535	Computer-Aided Geometric Design	3	M E 765	Advanced Heat Transfer II- Convection	3
M E/COMP SCI/ E C E 539	Introduction to Artificial Neural Network and Fuzzy Systems	3	M E 769	Combustion Processes	3
M E/E M A 540	Experimental Vibration and Dynamic System Analysis	3	M E 770	Advanced Experimental Instrumentation	3
M E 545	Fluid Power	3	M E 773	Boundary Layer Theory	3
M E 549	Product Design	3	M E 774	Chem Kinetics of Combust Systems	3
M E/COMP SCI/ I S Y E 558	Introduction to Computational Geometry	3	M E 775	Turbulent Heat and Momentum Transfer	3
M E 561	Intermediate Thermodynamics	3	M E/E P 777	Vacuum Technology	3
M E 563	Intermediate Fluid Dynamics	3	M E 790	Master's Research and Thesis	1-9
M E 564	Heat Transfer	3	M E 890	PhD Research and Thesis	1-9
M E/N E 565	Power Plant Technology	3	M E 903	Graduate Seminar	0
M E/E P 566	Cryogenics	3	M E/CBE/CHEM/ E M A 925	Rheology Research Seminar	1
M E/CBE 567	Solar Energy Technology	3	M E 964	Special Advanced Topics in Mechanical Engineering	1-3
M E 569	Applied Combustion	3	M E 990	Dissertator Research and Thesis	1-9
M E/E M A 570	Experimental Mechanics	3	M E 999	Advanced Independent Study	1-5
M E 572	Intermediate Gas Dynamics	3			
M E 573	Computational Fluid Dynamics	3			
M E/E C E 577	Automatic Controls Laboratory	4			
M E 601	Special Topics in Mechanical Engineering	1-3			
M E/I S Y E 641	Design and Analysis of Manufacturing Systems	3			
M E/I S Y E 643	Performance Analysis of Manufacturing Systems	3			
M E 699	Advanced Independent Study	1-3			
M E 702	Graduate Cooperative Education Program	1-2			
M E/E M A 706	Plates, Shells and Pressure Vessels	3			
M E/E M A 708	Advanced Composite Materials	3			
M E 714	Advanced Materials Processing and Manufacturing	3			
M E 717	Advanced Polymer Processing	3			
M E 718	Modeling and Simulation in Polymer Processing	3			
M E/E M A 722	Introduction to Polymer Rheology	3			
M E/E C E 739	Advanced Robotics	3			
M E 740	Advanced Vibrations	3			
M E 746	Dynamics of Controlled Systems	3			
M E 747	Advanced Computer Control of Machines and Processes	3			
M E 748	Optimum Design of Mechanical Elements and Systems	3			
M E 751	Matrix Methods in the Design and Analysis of Mechanisms	3			
M E 753	Friction, Lubrication and Wear	3			
M E 758	Solid Modeling	3			
M E/COMP SCI/ E C E/E M A/E P 759	High Performance Computing for Applications in Engineering	3			
M E 761	Topics in Thermodynamics	3			

## NAMED OPTIONS (SUB-MAJORS)

A named option is a formally documented sub-major within an academic major program. Named options appear on the transcript with degree conferral.

- Mechanical Engineering: Automotive Engineering, M.S. (<http://guide.wisc.edu/graduate/mechanical-engineering/mechanical-engineering-ms/mechanical-engineering-automotive-engineering-ms>)
- Mechanical Engineering: Controls, M.S. (<http://guide.wisc.edu/graduate/mechanical-engineering/mechanical-engineering-ms/mechanical-engineering-controls-ms>)
- Mechanical Engineering: Modeling and Simulation in Mechanical Engineering, M.S. (<http://guide.wisc.edu/graduate/mechanical-engineering/mechanical-engineering-ms/mechanical-engineering-modeling-simulation-mechanical-engineering-ms>)

## POLICIES

### GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (<https://grad.wisc.edu/acadpolicy>) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

### MAJOR-SPECIFIC POLICIES GRADUATE PROGRAM HANDBOOK

The Graduate Program Handbook (<https://www.engr.wisc.edu/app/uploads/2017/01/ME-Grad-handbook-Update-August-2017-Final.pdf>) is the repository for all of the program's policies and requirements.

## PRIOR COURSEWORK

### Graduate Work from Other Institutions

With program approval, students are allowed to count graduate coursework from other institutions (up to 50% of the formal course requirement) toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. No credits from other institutions can be counted toward the minimum graduate residence credit requirement. Coursework earned five or more years prior to admission is not allowed to satisfy requirements.

### UW–Madison Undergraduate

Up to 7 credits numbered 400 or above may be counted toward the minimum graduate degree credit requirement. These credits may be counted toward the minimum graduate coursework (50%) requirement if they are in courses numbered 700 or above. No credits may be counted toward the minimum graduate residence credit requirement. Coursework earned five or more years prior to admission to a master's degree is not allowed to satisfy requirements.

### UW–Madison University Special

With program approval, and payment of the difference in tuition, students are allowed to count up to 15 credits of coursework numbered 400 or above taken as a UW–Madison Special student toward the minimum graduate residence credit requirement and the minimum graduate degree credit requirement. These credits may be counted toward the minimum graduate coursework (50%) requirement if they are in courses numbered 700 or above. Coursework earned five or more years prior to admission is not allowed to satisfy requirements.

## PROBATION

The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

1. Good standing (progressing according to standards; any funding guarantee remains in place).
2. Probation (not progressing according to standards but permitted to enroll; loss of funding guarantee; specific plan with dates and deadlines in place in regard to removal of probationary status).
3. Unsatisfactory progress (not progressing according to standards; not permitted to enroll, dismissal, leave of absence or change of advisor or program).

A semester GPA below 3.0 will result in the student being placed on academic probation. If a semester GPA of 3.0 is not attained during the subsequent semester of full time enrollment (or 12 credits of enrollment if enrolled part-time), this will be deemed unsatisfactory progress and the student may be dismissed from the program or allowed to continue for one additional semester based on advisor appeal to the Graduate School.

## ADVISOR / COMMITTEE

All students are required to obtain a mechanical engineering faculty advisor who assists them in planning a course sequence that meets

degrees requirements and who will discuss career objectives with the students.

Thesis-track: An M.S. thesis committee must include the student's mechanical engineering faculty advisor and at least two other members: one other graduate faculty or former graduate faculty up to one year after resignation or retirement, and one of the following: a third graduate faculty member, a retired faculty member with emeritus status, or a UW–Madison research scientist with principal investigator status who has been approved by the M E executive committee.

## CREDITS PER TERM ALLOWED

15 credits

## TIME CONSTRAINTS

Master's degree students who have been absent for five or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.

## OTHER

n/a

## PROFESSIONAL DEVELOPMENT

## GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (<https://grad.wisc.edu/pd>) to build skills, thrive academically, and launch your career.

## LEARNING OUTCOMES

1. Demonstrate a strong understanding of mathematical, scientific, and engineering principles in the field.
2. Demonstrate an ability to formulate, analyze, and independently solve advanced engineering problems.
3. Apply the relevant scientific and technological advancements, techniques, and engineering tools to address these problems.
4. Recognize and apply principles of ethical and professional conduct.

## PEOPLE

**Faculty:** Professors Gandhi (chair), Lorenz, Nellis, Osswald, Pfothenauer, Rowlands, Rutland, Sanders, Shapiro, Thelen, Turng; **Associate Professors** Krupenkin, Negrut, Pfefferkorn, Ploeg, Qian, Rothamer, Suresh, Trujillo, Zinn; Assistant Professors Adamczyk, Eriten, Henak, Kokjohn, Miller, Min, Roldan-Alzate, Rudolph; **Faculty affiliates** Allen, Bonazza, Holloway, Luzzio, Reindl, Scarlat, Schauer