MECHANICAL ENGINEERING, PH.D.

The doctoral program in the Department of Mechanical Engineering prepares students to perform independent research in areas of faculty expertise within the department. The Ph.D. program in Mechanical Engineering is designed to train outstanding students for advanced work in industry, national labs, and academia through a combination of coursework and hands on research.

Ph.D. students are mentored by faculty to become world-class researchers. The Department of Mechanical Engineering has a long history of excellence in graduate education. The department is consistently ranked in the top 20 in the United States for graduate programs in mechanical engineering. The department offers research opportunities in a large number of established and emerging research specializations. Broad research themes within the department include: biomechanics, computational engineering, energy, manufacturing, and mechanics and controls. Excellent research facilities are available for specialized research within these broad areas for studies in: biomechanics, combustion, computational design, controls, cryogenics, dynamics and vibrations, fluid dynamics, fluid power, geometric modeling and prototyping, heat and mass transfer, internal combustion engines, laser diagnostics, manufacturing processes, mechanics, mechatronics, polymer and composites processing, powertrain control, robotics, solar energy, and more.

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 PhD degree website (https://www.engr.wisc.edu/department/mechanical-engineering/academics/phd-in-mechanical-engineering).

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 Ph.D. 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. 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).

More information on graduate student funding is available from the Graduate School's Office of Fellowships and Funding Resources (http://grad.wisc.edu/studentfunding/currentstudents).

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/policiesandrequirementstext), in addition to the program requirements listed below.
MAJOR REQUIREMENTS

MODE OF INSTRUCTION Definitions

MODE OF INSTRUCTION

- **Face to Face**: These programs are offered primarily on-campus. All courses are offered on campus with minimal disruption to your career.
- **Evening/Weekend**: These programs are offered on-campus with a partial or completely online semester. For more information about the schedule, 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.
- **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

- **Minimum Residence Credit Requirement**: 32 credits

- **Minimum Graduate Coursework Requirement**: Half of degree coursework (30 credits out of 60 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide (http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle).

- **Overall Graduate GPA Requirement**: 3.25 GPA required.

- **Other Grade Requirements**: Students must earn a C or above in all formal coursework. Ph.D. candidates may not have any more than two Incompletes on their record at any one time.

- **Assessments and Examinations**: The Ph.D. candidate will need to pass a qualifying exam, preliminary exam, and a final defense in order to obtain a degree.

- **Language Requirements**: No language requirements.

- **Doctoral Minor/Breadth Requirements**: All doctoral students are required to complete a minor. Students pursuing an Option B (distributed) minor must take a minimum of 12 course credits. The coursework should form a coherent group of courses for which the graduate credit is allowed. The approval of the advisor and the graduate committee are required.

REQUIRED COURSES

Two semesters of M E 903 Graduate Seminar are required. These should be taken the first two semester the student is in residence. If an M.S. degree is received at UW–Madison, additional M E 903 M E 903 credits are not required.

A minimum of 42 formal course credits beyond the B.S. degree. This includes a minimum of five course numbers numbered 700 of higher (excluding M E 964 Special Advanced Topics in Mechanical Engineering courses unless specifically approved). Four of the five 700-level courses must be taken at UW–Madison. A minimum of two of the 700-level courses must be taken Mechanical Engineering at UW–Madison. Acceptable courses for the remainder of the required 42 formal course credits (this total includes the courses taken for the PhD minor requirement) are those numbered 400 and above.


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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>M/E/B M E 415</td>
<td>Biomechanics of Human Movement</td>
<td>3</td>
</tr>
<tr>
<td>M E 417</td>
<td>Transport Phenomena in Polymer Processing</td>
<td>3</td>
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<tr>
<td>M E 418</td>
<td>Engineering Design with Polymers</td>
<td>3</td>
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<tr>
<td>M E 419</td>
<td>Fundamentals of Injection Molding</td>
<td>3</td>
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<tr>
<td>M E 420</td>
<td>Introduction to Polymer Composites Processing</td>
<td>3</td>
</tr>
<tr>
<td>M/E/STAT 424</td>
<td>Statistical Experimental Design</td>
<td>3</td>
</tr>
<tr>
<td>M E/CBE/CHM/ E M A 425</td>
<td>Undergraduate Rheology Seminar</td>
<td>1</td>
</tr>
<tr>
<td>M E 429</td>
<td>Metal Cutting</td>
<td>3</td>
</tr>
<tr>
<td>M E 437</td>
<td>Advanced Materials Selection</td>
<td>3</td>
</tr>
<tr>
<td>M/E/E C E 439</td>
<td>Introduction to Robotics</td>
<td>3</td>
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<tr>
<td>M E 440</td>
<td>Intermediate Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>M/E/BSE/ FOOD SCI 441</td>
<td>Rheology of Foods and Biomaterials</td>
<td>3</td>
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<tr>
<td>M E 444</td>
<td>Design Problems in Elasticity</td>
<td>3</td>
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<tr>
<td>M E 445</td>
<td>Mechatronics in Control &amp; Product Realization</td>
<td>3</td>
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<tr>
<td>M E 446</td>
<td>Automatic Controls</td>
<td>3</td>
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<tr>
<td>M E 447</td>
<td>Computer Control of Machines and Processes</td>
<td>3</td>
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<tr>
<td>M E 448</td>
<td>Mechanical Systems Analysis</td>
<td>3</td>
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<tr>
<td>M E 449</td>
<td>Redesign and Prototype Fabrication</td>
<td>3</td>
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<tr>
<td>M E 450</td>
<td>Design and Dynamics of Vehicles</td>
<td>3</td>
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<tr>
<td>M E 451</td>
<td>Kinematics and Dynamics of Machine Systems</td>
<td>3</td>
</tr>
<tr>
<td>M E 460</td>
<td>Applied Thermal / Structural Finite Element Analysis</td>
<td>3</td>
</tr>
<tr>
<td>M E 461</td>
<td>Thermal Systems Modeling</td>
<td>3</td>
</tr>
<tr>
<td>M/E/M S &amp; E 462</td>
<td>Welding Metallurgy</td>
<td>3</td>
</tr>
</tbody>
</table>
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 up to 24 credits of graduate coursework from other institutions 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 ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

UW–Madison Undergraduate

Up to 7 credits numbered 400 or above can be counted toward the minimum graduate degree credit requirement. These credits may be counted toward the minimum graduate coursework (50%) requirement if they are from courses numbered 700 or above. No credits can be counted toward the minimum graduate residence credit requirement. Coursework earned ten years or more prior to admission to a doctoral 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 ten years or more prior to admission to a doctoral degree 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 3.25 will result in the student being placed on academic probation. If a semester GPA of 3.25 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 department.

ADVISOR / COMMITTEE

All students must have a mechanical engineering faculty advisor who assists them in planning a course sequence that meets degree requirements, who helps guide them and mentor them in their research, and who will discuss career objectives with the student. A qualifying exam committee must include the student’s mechanical engineering faculty advisor and two other mechanical engineering faculty members. A preliminary committee must include the student’s mechanical engineering faculty advisor and at least three other members who will also serve on the final oral defense committee. A final oral defense committee must include the student’s mechanical engineering faculty advisor and at least four other members, three other graduate faculty or former graduate faculty up to one year after resignation or retirement, and one of the following: another graduate faculty, a retired faculty member with emeritus status, or a UW–Madison research scientist with principal investigator status who has been approved by the ME executive committee. At least one faculty member on the committee must be from outside of the ME department.

CREDITS PER TERM ALLOWED

15 credits

TIME CONSTRAINTS

Ph.D. students must take the qualifying exam no later than the second time it is offered after completing 30 credits. Students entering the program with an MS degree must take the exam no later than the second time it is offered after entering the program.

Ph.D. students must complete their preliminary exam within five years of passing their qualifying exam.

The preliminary must be passed at least 9 months prior to the thesis defense.

A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within five years after passing the preliminary examination may be required to take another preliminary examination to be admitted to candidacy a second time.

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 an extraordinary, deep 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.

5. Demonstrate an ability to synthesize knowledge from a subset of the biological, physical, and/or social sciences to help frame problems critical to the future of their discipline.

6. Demonstrate an ability to conduct original research and communicate it to their peers.

**PEOPLE**

**Faculty:** Professors Ghandhi (chair), Lorenz, Nellis, Osswald, Pfotenhauer, 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