

PH.D. IN MECHANICAL ENGINEERING

OVERVIEW

The Doctor of Philosophy in Mechanical Engineering at The University of Toledo is offered through the Department of Mechanical, Industrial and Manufacturing Engineering (MIME) in the College of Engineering. The program is open to qualified students with bachelor's or master's degrees in mechanical engineering or closely related STEM disciplines who demonstrate strong academic preparation, research potential, and effective technical communication. Students complete a rigorous program of advanced coursework and independent research totaling 60–90 credit hours, depending on prior preparation, culminating with a dissertation proposal, and the writing and successful defense of an original doctoral dissertation.

The program emphasizes research in two primary focus areas: thermal-fluid sciences and materials, design, and manufacturing. Students engage in research spanning advanced manufacturing, sustainable energy systems, computational fluid dynamics, artificial intelligence applications, and biomechanics, supported by state-of-the-art laboratory facilities and strong collaborations with industry, government agencies, and national laboratories. Students in the program develop the skills needed to conduct independent, high-impact research and to assume leadership roles in academia, industry, and government.

ADMISSIONS REQUIREMENTS

Admission for the Ph.D. program in Mechanical Engineering requires the M.S. in Mechanical Engineering or another engineering field provided the student shows evidence of an appropriate engineering background at the undergraduate level, including a minimum of two years of calculus through differential equations and one year of physics. Highly qualified B.S. engineering graduates can be admitted directly into the Ph.D. program.

Application requirements:

- **Degree:** Applicants must hold a master's degree from a regionally accredited college or university
- **GPA:** Applicants must have at least a 3.0/4.0 grade point average from previous undergraduate coursework or a 3.3/4.0 for previous graduate coursework
- **Application:** UToledo application required
- **GRE:** Not required
- **Transcripts:** Required
- **Statement of Purpose:** Required
- **Letters of Recommendation:** 2 minimum; 3 preferred

- **Proof of English language proficiency:** Required for students from non-English speaking countries. See University graduate admissions for minimum test score requirements and exceptions.

Application priority deadlines for admissions and funding decisions:

- **Fall:** March 15
- **Spring:** October 1
- **Summer:** January 15

Program Requirements

Students entering the doctoral program with a bachelor's degree must complete 45 cr hr of graduate coursework, of which 36 cr hr are regular departmental graduate courses beyond their bachelor's degree, and at least 27 cr hr must be at the 6000/8000 level. For students entering the program with an MS degree, a minimum of 15 cr hr of 8000-level graduate coursework (not including dissertation) taken for a letter grade is required for the doctoral degree program. Twelve of these 15 cr hr must be departmental graduate courses. Other courses taken may include non-departmental courses, independent study courses, and courses taken S/U.

In addition to the above course requirements, all funded students are required to enroll and participate in a graduate seminar (MIME 8930 (<https://catalog.utoledo.edu/search/?P=MIME%208930>) or equivalent) each semester. The department may specify additional credit or non-credit requirements for satisfactory completion as well as enhancement of degree objectives.

The course list table below includes the program requirements for a student entering with a BS degree. This table lists the three core courses to be taken by all students and the one required course to be taken by the students depending on their focus areas.

Code	Title	Hours
Core courses		9
MIME 8000	Advanced Engineering Mathematics I	
MIME 5300	Advanced Mechanics Of Materials	
MIME 8460	Intermediate Fluid Mechanics and Heat Transfer	
MIME 8930	Graduate Seminar	
Required course depending on the focus area.		3
Students following the materials, design and manufacturing focus area, need to take at least one of the following courses:		
MIME 5060	Manufacturing Engineering	
MIME 8720	Design of Experiments	
MIME 8200	Advanced Dynamics	
Students following the thermal-fluid focus area need to take at least one course from the following:		
MIME 8440	Computational Fluid Dynamics I	
MIME 8470	Advanced Computational Fluid Dynamics	
MIME 8450	Experimental Fluid Mechanics	
Additional elective coursework		33
Research		45

MIME 8960 Dissertation

Total Hours

90

For transfer credit, students should refer to the general policies of the College of Graduate Studies.

The doctoral degree plan of study is developed jointly by the student and the dissertation adviser, subject to the approval of the department chair or graduate program director.

A complete list of elective coursework with course descriptions is provided in Appendix B. A minimum cumulative GPA of 3.0/4.0 in graduate coursework is required for graduation. A grade of C is the minimum passing grade for graduate courses. All graduate level coursework is included in the calculation of the cumulative grade point average.

Doctoral Qualifying Examination

The Ph.D. Qualifying Exam is designed to give the student's doctoral research committee an opportunity to evaluate the student's academic abilities and promise in a doctoral program. The exam seeks to assess the students' research performance, their understanding of the requisite engineering fundamentals, their capacity to think clearly, and their ability to express their technical knowledge.

The Ph.D. in Mechanical Engineering can be completed in one of two research focus areas:

- Materials, Design and Manufacturing
- Computational and Experimental Thermal Sciences

The Ph.D. qualifying exam in mechanical engineering includes earning minimum grades of "A-" in **three of the four courses taken** within the focus area (see course listing table). These classes must be taken by all students (with or without a prior MS degree) who are seeking a Ph.D. degree in mechanical engineering at The University of Toledo. The **student's doctoral committee** can decide (before the start of the third semester) what **additional courses a student must take** if the grade requirement is not met.

Students must present to their committee their research topic (i.e. research questions, literature review, and preliminary data if available) during their second year. The committee can probe fundamental understanding of the students related to their research. This is different than research progress and can focus on fundamentals in a student's area of study. Committee members will decide whether (1) the student is on the right track in research and (2) if the student has fundamental understanding related to the research area. If the committee members deem appropriate, they can suggest additional courses related to the student's research area and to improve fundamental understanding of the students. This can include an independent study with a research advisor.

If a student does not satisfy grade requirements in core classes or other classes suggested by the Ph.D. committee, the committee must assess student's research performance, fundamental understanding, and grades to decide whether the student can continue in the PhD program. The PhD committee members will vote to make the final decision.

Students are considered PhD candidates after passing the PhD qualifying examinations. When the above requirements have been met, the student

may file his/her application for doctoral candidacy. The department requires that the application be filed within one year of the time the doctoral qualifying examination is passed. Doctoral students must have established candidacy for the doctoral degree before presenting and defending dissertation research.

Students who do not successfully complete the qualifying examinations will ordinarily not be permitted to continue in the Ph.D. program. Such students may petition the department for special consideration. This petition must be made within one month after the date examination results have been mailed out. The student's doctoral examination committee chaired by the faculty advisor, and in consultation with the Graduate Director and/or the Chair will then either (1) confirm the examination results (the student will then no longer be considered as a participant of the Ph.D. program) or (2) reverse the decision; or (3) recommend that the student be allowed to take the examination again, possibly subject to specific performance standards.

Doctoral Dissertation Proposal

Students must write a dissertation proposal and present it to the doctoral dissertation committee and successfully defend it during a formal proposal defense. Students can schedule their dissertation defense a semester following their successful proposal defense. Summer can count as a semester. The proposal documents the study through a brief introduction to the subject stating the dissertation purpose and including a list of references, which will indicate that the student has performed a thorough literature search. The proposal serves to:

1. Provide an opportunity for the student's doctoral examination committee to offer suggestions and references on the work conducted and the work to be conducted.
2. Provide a safeguard against duplication of research effort.

Therefore, it is important that the dissertation proposal be written prior to and not after the research has been completed.

Dissertation Defense

The dissertation defense is an oral examination intended to verify that the research represents the candidate's own contribution to knowledge and to test his or her understanding of the research. The examination is normally open to the public and should not exceed three hours in length. A candidate in the oral examination is expected to:

1. Present a comprehensible account of the research and its potential consequences to scholars whose special areas of interest lie outside the candidate's area of research.
2. Demonstrate his or her ability to explain and defend the dissertation and its contribution to knowledge before the Doctoral Examination Committee and other experts in the field; and
3. Demonstrate the capabilities for which a Ph.D. degree is awarded by answering satisfactorily any questions considered pertinent by the examining committee.

Dissertation Publication

The Doctoral Dissertation Committee, chaired by the Dissertation Advisor has the responsibility of supervising the candidate's research work and ensuring that high standards of performance are maintained. To that end, it is the candidate's responsibility to keep the committee members

informed about his or her research progress. A satisfactory completion of the research work is usually implied if technical papers are accepted for publication in professional archival journals.

Doctoral Dissertation

After the student and the adviser have agreed on a dissertation topic, the student must write a dissertation proposal. The student will present the proposal to the doctoral dissertation committee and successfully defend his/her dissertation proposal.

The signatures of the committee on the candidate's dissertation indicate approval of the dissertation research and represent the final certification of its adequacy.

This is a suggested plan of study for students following a PhD in ME with the materials, design and manufacturing focus area.

First Term		Hours
Credit from prior MS degree; if no prior MS, additional coursework required		24
Hours		24
First Year		
First Term		
MIME 5300	Advanced Mechanics Of Materials	3
MIME 8000	Advanced Engineering Mathematics I	3
MIME 8960	Dissertation	3
MIME 8930	Graduate Seminar	0
Hours		9
Second Term		
MIME 8200	Advanced Dynamics	3
MIME 8460	Intermediate Fluid Mechanics and Heat Transfer	3
MIME 8960	Dissertation	3
MIME 8930	Graduate Seminar	0
Hours		9
Third Term		
MIME 8960	Dissertation	6
Hours		6
Second Year		
First Term		
MIME 5060	Manufacturing Engineering	3
MIME 8720	Design of Experiments	3
MIME 8960	Dissertation	3
MIME 8930	Graduate Seminar	0
Hours		9
Second Term		
MIME 8650	Advanced Material Science and Engineering	3
MIME 8960	Dissertation	6
MIME 8930	Graduate Seminar	0
Hours		9

Third Term		
MIME 8960	Dissertation	6
Hours		6
Third Year		
First Term		
MIME 8930	Graduate Seminar	0
MIME 8960	Dissertation	9
Hours		9
Second Term		
MIME 8960	Dissertation	6
MIME 8930	Graduate Seminar	0
Hours		6
Third Term		
MIME 8960	Dissertation	1
Hours		1
Fourth Year		
First Term		
MIME 8960	Dissertation	1
Hours		1
Second Term		
MIME 8960	Dissertation	1
Hours		1
Total Hours		90

- 1) Demonstrate technical proficiency in topics aligned with their focus area.
- 2) Deliver clear and concise written and oral presentations for doctoral level course projects.
- 3) Deliver clear and concise written and oral presentations of their doctoral research.
- 4) Generate high quality engineering research that is original, significant and consequential, and is publishable in high quality journals, book chapters, and conference proceedings.
- 5) Contribute to research proposals in collaboration and / or under the guidance of the faculty advisor.
- 6) Teach undergraduate engineering courses.