Mechanical Engineering, MS

The mechanical engineering graduate program in the College of Engineering emphasizes in-depth learning and research. In collaboration with faculty across campus, the mechanical engineering faculty currently research a diverse range of topics within the field. For more information, see the Department of Mechanical Engineering website.

Design and Uncertainty Quantification

The Design and Uncertainty Quantification focus area is concerned with the design optimization of complex mechanical systems in the presence of uncertainty. The focus area emphasizes the development of sound theoretical foundations, novel computational methods and algorithms, and modern software tools aimed at creating state-of-the-art engineering designs of automotive, aerospace, naval, nuclear, and biomedical systems. Current areas of excellence include artificial muscles and smart materials design, ship hydrodynamics, design sensitivity analysis, uncertainty quantification, and reliability-based design optimization.

Fluid Dynamics

The Fluid Dynamics focus area covers a wide variety of topics with the flow of liquids and gases as the common denominator. The graduate program in fluid dynamics emphasizes fundamental principles and applications, and the numerical and experimental techniques used to obtain and analyze fluid flows. Areas of concentration include computational fluid dynamics, experimental fluid dynamics, medical flows, naval hydrodynamics, biologically inspired air and underwater vehicles, multiphase flows, cavitation and ventilation, and fluid-structure interaction and turbulence, among others.

Heat Transfer and Combustion

The Heat Transfer and Combustion focus area applies to real-world systems in manufacturing and materials processing, propulsion, energy production, and other areas. The graduate program emphasizes the fundamental principles and techniques required for experimental and theoretical research. Current areas of research include solidification of materials, metal casting, 3D printing, laser-materials interaction, power plants and propulsion devices such as automobile and aircraft engines, energy conservation and production, energy storage, complex reactive materials, and machine learning in computational modeling and simulation.

Manufacturing and Materials

The Manufacturing and Materials focus area involves fundamental materials processing science, technological advancement in manufacturing applications, and the development of new manufacturing processes and new material functions. Current and emerging thrust areas include solidification, metal casting, laser materials processing, micro- and nanofabrication, joining, ultrasonic welding, machining, microstructure evolution, manufacturing process modeling and simulation, artificial muscles, artificial camouflage, smart materials, and material characterizations. These research activities are well supported by federal and state agencies and the manufacturing industry.

Robotics, Controls, and Autonomous Systems

Robotics, Controls, and Autonomous Systems (RCAS) are concerned with the modeling, analysis, design, and control of dynamic systems. The graduate program in RCAS emphasizes the fundamental principles and techniques of robotics, control theory, and artificial intelligence. Areas of concentration include computational intelligence, dynamic autonomous systems, cyber-physical systems, and networked robotic systems with potential applications in self-driving cars; medical and assistive robots for surgery and rehabilitation; industrial co-robots for human-robot collaboration; and uncrewed aerial, ground, and underwater vehicles.

Solid Mechanics and Multibody Dynamics

Solid Mechanics and Multibody Dynamics are concerned with the behavior of solid materials and flexible bodies, especially their deformation, motion, and stress responses under the action of applied loads. The graduate program in solid mechanics and multibody dynamics emphasizes the theoretical foundations and problem-solving techniques for engineering applications. Current research focuses of the faculty include multiscale mechanics of materials, biomechanics, vehicle dynamics, computational mechanics, multibody dynamics, and optimization.

Learning Outcomes

Graduates will:

- have a broad knowledge of mechanical engineering topics and advanced knowledge in their specific area of study;
- be able to analyze engineering problems and apply their knowledge to solve them, and thesis option graduates able to solve research-oriented problems; and
- develop professional skills that include effective communication, leadership, and ethical conduct in professional, social, and scholarly activities.

Requirements

The Master of Science program in mechanical engineering requires a minimum of 30 s.h. of coursework and research, including a minimum of 12 s.h. in mechanical engineering courses (prefix ME) numbered 5000 or above. Students must maintain a UI cumulative grade-point average of at least 3.00 in graduate work used to satisfy their requirements to earn the degree. The course plan should be approved by their advisor prior to registration each semester. All students choose either a thesis or nonthesis program.

The requirements for the MS may be completed within one calendar year. However, students with assistantship duties or other constraints may take up to two calendar years to complete their degree. Students must complete ENGR:7270 Engineering Ethics during their first fall semester in the program. They must register for ME:6191 Graduate Seminar: Mechanical Engineering each fall and spring semester until the successful completion of their final examination or thesis defense; credit in these courses does not substitute for regular coursework or research credit hours. For students who select the thesis option, normally 6 s.h., and no more than 9 s.h. of credit for thesis research is counted toward degree

requirements in ME:6199 Research: Mechanical Engineering MS Thesis.

Thesis students must be successful in their final examination. The exam is administered by a student's committee, which consists of at least three faculty members, including at least one with a primary appointment in the Department of Mechanical Engineering. The nonthesis option does not include a final exam.

Admission

Applicants must meet the admission requirements of the Graduate College; for detailed information about Graduate College policies, see the Manual of Rules and Regulations on the Graduate College website.

Applicants who have earned a baccalaureate or master's degree in engineering curriculum or in the mathematical or physical sciences are eligible to be considered for admission to graduate study in mechanical engineering. To be considered for regular admission, applicants must have a grade-point average (GPA) of at least 3.00 on a 4.00 scale in all previous college-level work.

Application Deadlines

Applications for fall: Jan. 15 (application deadline), March 1 (admission decision).

Applications for spring: Sept. 1 (application deadline), Oct. 1 (admission decision).

All requirements must be fulfilled by the respective deadlines. Applicants who apply after the deadline must be sponsored by a mechanical engineering faculty member for a deadline waiver.

Career Advancement

Engineering Career Services develops and promotes experiential education and professional opportunities for students in the College of Engineering. Professional staff coordinate the college's co-op and internship program, engage in employer outreach, and provide opportunities for students to network with employers, including an engineering career fair each semester and other programming related to career development.

Engineering Career Services offers individual advising and class presentations on résumé and cover letter preparation, job and internship search strategies, interviewing skills, job offer evaluation, and much more. Engineering Career Services partners with the Pomerantz Career Center to facilitate on-campus interviewing, postgraduation outcome collection, and the university's online recruiting system, Handshake.

Academic Plans

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Mechanical Engineering, MS

Course	Title	Hours
Academic Career		
Any Semester		
30 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website. [a, b]		
	Hours	**0**
First Year		
Fall		
ENGR:7270	Engineering Ethics [c, d]	1
ME required course [e]		3
ME required course [e]		3
ME required course or elective [e, f]		3
ME:6191	Graduate Seminar: Mechanical Engineering [d, g]	1
	Hours	**11**
Spring		
ME required course [e]		3
ME required course [e]		3
Elective course [f]		3
ME:6191	Graduate Seminar: Mechanical Engineering [d, g]	1
	Hours	**10**
Second Year		
Fall		
Elective course [f]		3
Elective course [f]		3
Elective course [f]		3
ME:6191	Graduate Seminar: Mechanical Engineering [d, g]	1
	Hours	**10**
Spring		
Elective course [f]		3
ME:6191	Graduate Seminar: Mechanical Engineering [d, g]	1
Final Exam [h]		
	Hours	**4**
	Total Hours	**35**

a Students may design their program around a particular research and study area; see General Catalog and ME website for specifics. Work with faculty advisor to determine appropriate graduate level coursework and sequence.

b Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.

c Must be completed during first semester.

d Credit for this course does not substitute for regular coursework or research credit hours.

e Minimum of 12 s.h. must be from Mechanical Engineering courses numbered 5000 or higher. Students may also select Mechanical Engineering courses numbered 4100 or higher except for ME:4186 which is not eligible for graduate credit.

f Work with academic advisor to determine appropriate elective coursework and sequence.

g Attendance required every fall and spring semester until degree completion.

h Completion of degree requirements.