Mechanical Engineering (M.S.M.E.)

About The Program:

The M.S.M.E. program provides students who already have an undergraduate Engineering degree with the credentials and background to pursue a career in industrial research and development. The program provides students from diverse basic science backgrounds with the fundamental technical engineering expertise necessary to work in an interdisciplinary field such as Bioengineering or Material Science. The program provides engineers who are currently employed with a means to further their technical capabilities through part-time study.

Career Options: Graduates with the M.S.M.E. in Mechanical Engineering are employed in high-tech industries and government laboratories in design, analysis, and applications. Typical employers include manufacturing companies; pharmaceutical and biotechnology companies; companies involved in research and development in fluid flow and heat transfer; computer-aided designers and manufacturers; computer technology firms; and government offices such as the U.S. Patent and Trademark Office. Students who complete an M.S.M.E. with a thesis are prepared to enter a doctoral program.

Prerequisites for Admission: A bachelor's degree in Mechanical Engineering is the preferred prerequisite degree. However, students who have earned a bachelor's degree in a related field are encouraged to apply, with the understanding that remedial preparatory courses may be a pre-condition of admission to the M.S.M.E. program.

Areas of Specialization:

Research is offered in:

- Biomaterials
- Composite materials and design
- Finite element analysis and computational fluid dynamics
- Fluidics and energetics
- Target drug delivery and tissue engineering

1. For the M.S.M.E. program, students also choose between three tracks:
2. The Thesis Track is intended for students pursuing advanced research and includes 24 credits of didactic coursework, 3 credits of Project (MEE 9995), and 3 credits of Thesis (MEE 9996).
3. The Project Track introduces students to applied research and includes 27 credits of didactic coursework and 3 credits of Project (MEE 9995).
4. The Coursework Track provides students with an advanced engineering background for their future in the engineering profession through 30 credits of didactic coursework.

In the first term, the student and the ME Graduate Program Director establish a graduate Plan of Study that outlines all required courses and the sequence for the student to follow. This form is used to track

the student's progress as the various benchmarks in the program are completed. Once established, any revisions to the Plan of Study require approval in advance. However, if considering whether to change one's track, the student should note that:

- "Thesis" credits (MEE 9996) can only be applied toward the Thesis M.S.M.E. Track and cannot be applied to either the Project or Coursework Tracks.
- "Project" credits (MEE 9995) can be applied toward the Thesis and Project M.S.M.E. Tracks but cannot be used for the Coursework Track.

Requirements of Programs:

- **Total Credit Hours**: 30
- **Culminating Events**:

Thesis Track:

The culminating events in the Thesis Track are typically undertaken during the last two successive terms of study. Successful completion requires the following:

Thesis Proposal — MEE 9995 Project (3 credits)

Under the guidance of the advisor, the student conducts independent research on an applied engineering topic of current interest and registers for MEE 9995. This work includes the research and preliminary results that form the basis of an extended study that the student plans to carry on in MEE 9996 Thesis in the following term. The student submits a research report as her/his Thesis Proposal to a committee consisting of three or more faculty members, including the faculty advisor, and presents her/his proposal in an open College-wide seminar, which is scheduled and posted at least 10 business days in advance of the presentation date. Immediately following the presentation, the student's advisory committee questions the student about the details and strategy of the proposed research. The committee then accepts, accepts with revisions, or rejects the proposal. The student must pass the Thesis Proposal before registering for MEE 9996. If the student fails Thesis Proposal, s/he may either re-register for MEE 9995 (1 credit) in the next regular term and repeat the entire proposal process or consider switching to the Project or Coursework Track. NOTE: A second failure of Thesis Proposal results in automatic dismissal from the University. If switching to another track, the Plan of Study form requires updating and appropriate approvals.

Thesis Defense — MEE 9996 Thesis (3 credits)

The student should register for MEE 9996 in the term that s/he plans to defend the thesis. The thesis document should be prepared in a format compliant with University standards. (See Graduate School Policy 02.26.12.02.) Two weeks prior to the thesis defense, the student provides the committee with a copy of the completed thesis and posts an announcement of the defense, which is to take place during a regular academic term (i.e., not scheduled during study days, final exams, or the breaks between terms). If the student is to graduate in the same term as the thesis defense is held, then the defense should take place at least 30 days prior to the end of the term.

The thesis defense is an open College seminar in which the student presents the concepts and results of her/his research. Immediately following the defense, the thesis committee convenes to closely examine the student's research and decide to accept the thesis as provided, accept the thesis with revisions, or not accept the thesis. If the thesis is accepted, a letter grade for MEE 9996 is assigned. If the thesis is accepted with revisions, then the student must submit the revised thesis within 30 days and with the approval of the Thesis Committee. If the thesis is not accepted, but the committee decides to not fail the student, an "R" grade is assigned to MEE 9996. In the following term, the student registers for one credit of ENGR 9991 Directed Research until s/he is again prepared to attempt the defense. The defense procedures described above are then carried out again in the term that the student is prepared to defend the thesis.

Project Track:

The culminating event for the Project Track is MEE 9995 Project. This entails a one-term research activity done under the supervision of a full-time faculty advisor on an applied engineering topic of interest. Near the end of the term, the student prepares a report of her/his findings and presents the study in an open departmental seminar. Both the seminar and the written report are used to determine the student's grade for MEE 9995. The grade is determined jointly by the advisor and another designated grader selected by the Graduate Program Director.

Coursework Track:

No culminating event is warranted for the Coursework Track.

Core Courses (Thesis Track)

Engineering Mathematics I - This is a survey course in essential mathematics for first-year graduate students in engineering and physical sciences. Topics include analytic methods in ordinary differential equations, complex-variable theory, the laplace transform and its inversion, and initial-value problems and boundary-value problems. Matlab, numerical methods, and introductory numerical algorithm design are introduced.

Select one additional course from the following:

Introduction to Mobile Robotics - How can one create mobile robots that operate autonomously in cluttered indoor and outdoor environments? How do robots determine their state and properties from noisy sensor data to accomplish navigation and manipulation tasks? The Introduction to Mobile Robotics course will address motion planning, control, sensing and estimation for mobile robots. The goal of the class is to train students to develop real-time planning and control software modules for robotic systems. Students taking this course are expected to be familiar with differential equations, linear algebra, and multi-variable calculus. Experience with programming in Matlab or Octave is recommended (and Matlab will be used in the course).

Power Generation and Storage Technologies – This course will give an overview of electric power generation technologies including coal, gas, and nuclear power plants, as well as some emerging technologies such as photovoltaic. This course will also discuss technologies used in power transmission and distribution such as overhead power line conductors. Power storage technologies will also be introduced including compressed air, flywheel, hydrogen, and batteries.

Cardiovascular Fluid Dynamics – Mechanics of blood circulation, fluid mechanics of the heart, blood flow in arteries, unsteady flow in veins, current concepts in circulatory assist devices, biofluidics, and other selected topics.

Electives (18 credits)

Non-Didactic Courses

Project – A project assigned with the approval of the Mechanical Engineering Graduate Committee and conducted under the supervision of a graduate faculty advisor. An oral presentation in an open seminar and a written report are required to complete the independent project. Projects related to industrial applications are encouraged. For non-thesis students only.

Thesis – Master's thesis. May be taken twice.

Core Courses (Project Track)

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Cardiovascular Fluid Dynamics – Mechanics of blood circulation, fluid mechanics of the heart, blood flow in arteries, unsteady flow in veins, current concepts in circulatory assist devices, biofluidics, and other selected topics.

Electives (21 credits)

Non-Didactic Courses

Project – A project assigned with the approval of the Mechanical Engineering Graduate Committee and conducted under the supervision of a graduate faculty advisor. An oral presentation in an open seminar

and a written report are required to complete the independent project. Projects related to industrial applications are encouraged. For non-thesis students only.

Core Courses (Coursework Track)

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Courses:

Click HERE for more information on the courses below.

- Probability and Statistics in Engineering
- Probability Statistics in Engineering
- Special Topics
- Transportation Systems Management
- Transportation Engineering
- Structural Design of Pavements
- Bridge Design
- Transportation Engineering Materials
- Intelligent Transportation Systems
- Airport Engineering
- Pavement Management and Traffic Systems Management
- Introduction to Geosynthetics
- Pavement Rehabilitation and Maintenance
- Construction Administration
- Engineering Project Management
- Construction Financial Management

- Construction Equipment Management
- Geotechnical Engineering
- Structural CADD Systems
- Structural Dynamics
- Behavior and Design of Steel Structures
- Structural Mechanics
- Behavior and Design of Masonry Structures
- Behavior and Design of Reinforced Concrete Structures
- Earthquake Engineering and Seismic Design
- Life Cycle Assessment and Carbon Footprinting
- Engineering Hydrology
- Fate of Pollutants in Subsurface Environments
- Contaminant Dynamics in Urban Streams
- Environmental Hydrology
- Urban Streams and Stormwater Management
- Physical Principals of Environmental Systems
- Chemical Principles of Environmental Systems
- Mathematical Modeling
- Air Pollution Control
- Weather Monitoring and Forecasting
- Solid Wastes Engineering
- Environmental Chemistry
- Environmental Organic Chemistry
- Chemistry for Environmentally Sustainable Engineering
- Sustainable Development and Industrial Ecology
- Sustainability Aspects of Water Supply and Wastewater Treatment
- Membrane Separation in Wastewater Treatment
- Biological Principles of Environmental Systems
- Environmental Biotechnology
- Advanced Biological Wastewater Treatment
- Aquatic Toxicology in Environmental Engineering
- Environmental Engineering
- Advanced Soil Mechanics
- Foundation Engineering
- Earth Retaining Systems
- Geotechnical Earthquake Engineering
- Advanced Project Management
- Advanced Physical/Chemical Treatment Processes
- Advanced Chemical Principles of Environmental Systems. 3
- Computer Modeling of Environmental Transport
- Water and Wastewater Systems Design
- Independent Study I
- Directed Research
- Preliminary Examination Preparation
- Project
- Thesis