Mechanical Engineering, M.S.M.E.

COLLEGE OF ENGINEERING (http://engineering.temple.edu)

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.

Time Limit for Degree Completion: 5 years

Campus Location: Main

Full-Time/Part-Time Status: The degree program can be completed on a full- or part-time basis.

Interdisciplinary Study: The program encourages interdisciplinary research with other branches of engineering as well as with various departments of the College of Science and Technology and the School of Medicine. Faculty are also collaborating with investigators in the Department of Civil and Environmental Engineering on water turbulence studies; in the Department of Electrical and Computer Engineering on heat dissipation in microelectronic components; and in the Department of Physics on nanotechnology research.

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

Job Prospects: 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.

Non-Matriculated Student Policy: Up to 9 credits of graduate Engineering coursework may be taken at Temple University on a non-matriculated basis and subsequently applied to the M.S.M.E. degree upon admission. If the applicant's undergraduate GPA was less than 3.0, a GPA of 3.25 or better is required on this non-matriculated graduate coursework to receive an admissions exception. Consequently, the Mechanical Engineering (ME) Graduate Program Director may encourage those with an undergraduate GPA less than 3.0 to take their first three graduate courses prior to making formal application to the M.S.M.E. program. (See the relevant Graduate School policies on special admission procedures for non-matriculated students: 02.23.11.03 (http://www.temple.edu/grad/policies/gradpolicies.htm) and 02.24.19 (http://www.temple.edu/grad/policies/gradpolicies.htm).)

Financing Opportunities: Three forms of financial aid are offered to graduate students:

1. Teaching Assistantship (TA): TA awards are made solely by the Department and require the awardee to work 20 hours per week in support of the Department's undergraduate programs. The TA is compensated with a 9-month stipend, a basic health-insurance plan, and 9 credits per term of tuition remission.

2. Research Assistantship (RA): Individual ME faculty confer RA awards, using their research funds, upon students who appear well-qualified to carry out the research. Typically, this faculty member becomes the RA's Thesis advisor. The RA normally works up to 20 hours per week and is compensated with a stipend, basic health insurance, and tuition remission.

3. Fellowships: These highly competitive University-wide grants are typically awarded only to Ph.D.-program applicants. See the Engineering, Ph.D. (http://bulletin.temple.edu/graduate/scd/engineering/engineering-phd) program description for details.

Admission Requirements and Deadlines

Application Deadline:

Fall: March 1
Spring: November 1; August 1 international

Applications are processed on a continual basis. Late applications may be considered for admission. Ordinarily, the applicant is informed of an admissions decision within 4 to 6 weeks of receipt of all supporting application documents.
Applicants who plan to matriculate full-time are automatically considered for financial aid awards so no separate application for financial aid is required. To ensure financial aid consideration for the intended term of study, however, applicants should submit a complete application by January 15 (Fall) and August 1 (Spring).

Both admissions and financial aid award decisions originate in the Department of Mechanical Engineering (ME). Applicants are encouraged to contact the ME Graduate Program Director for advice and consultation in the application process.

APPLY ONLINE to this graduate program.

Letters of Reference:
Number Required: 3

From Whom: Letters of recommendation should be obtained from college or research faculty who are familiar with the applicant’s competency. If the applicant has an established career in engineering, one of the letters should be provided by the applicant’s immediate supervisor. If the applicant has been out of school long enough that relevant academic reference letters appear impractical, s/he should contact the ME Graduate Program Director to obtain a waiver of this admission requirement.

Coursework Required for Admission Consideration: Students not adequately prepared for advanced courses may be required to take a number of prerequisites. The ME Department identifies the needed coursework on a case-by-case basis.

Bachelor’s Degree in Discipline/Related Discipline: 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.

University regulations stipulate that the applicant must have earned a 3.0 grade-point average on a 4.0 scale in her/his undergraduate studies, but admission exceptions are made for a variety of circumstances. (See Graduate School Policy 02.23.11.03.) The ME Graduate Program Director helps the applicant navigate the admission possibilities, including the “Non-Matriculated Student Policy” option.

Statement of Goals: Describe your relevant technical experiences and career goals in one to two pages.

Standardized Test Scores:
GRE: Required. Scores must be no more than 5 years in advance of the application date. (See Graduate School Policy 02.23.12.) Applicants who require a waiver of the GRE should consult the ME Graduate Program Director concerning the mechanics and consequences of obtaining an exception.

TOEFL: 79 iBT or 550 PBT minimum. (See Graduate School Policy 02.23.13.01.)

Resume: Current resume required.

Transfer Credit: Graduate credits taken at an accredited institution prior to matriculation may be transferred into the M.S.M.E. program. In order to transfer, the courses must be equivalent to courses offered at Temple in the student’s area of study and research, and the grades must be “B” or better. The maximum number of credits a student may transfer is 6. (See Graduate School Policy 02.24.21.)

Test Waivers: Applicants with two or more years of employment in an engineering profession performing engineering design and analysis may request a waiver of the GRE. Consult with the ME Graduate Program Director concerning the mechanics and consequences of obtaining an exception.

Program Requirements

General Program Requirements:
Number of Credits Required Beyond the Baccalaureate: 30

Students choose between three tracks:

1. Thesis Track, which is intended for full-time students who have a financial aid award and includes 24 s.h. of didactic coursework and 6 s.h. of thesis (MEE 9996).

2. Project Track, which is intended for full-time students who are self-supporting and includes 27 s.h. of didactic coursework and 3 s.h. of project (MEE 9995).

3. Coursework Track, which is intended for self-supporting part-time students and entails 30 s.h. of didactic coursework.

In the first term, the student and ME Graduate Program Director jointly establish which track the student will follow; in doing this, they initiate the “M.S.M.E. Plan of Study.” The Plan of Study form lists all required courses and suggests an M.S.M.E. program-requirement execution sequence for the student to follow. This form is used to track the student’s progress, and is updated and annotated at least once a year as the student completes the various benchmarks in the M.S.M.E. program.
If a student's circumstances change, s/he can change tracks by revising the Plan of Study form and obtaining the requisite approval signatures. However, when 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. degree program and cannot be applied to either the Project or Coursework Tracks.
- "Project" credits (MEE 9995) can only be applied toward the Project M.S.M.E. degree program and cannot be used for either the Coursework or Thesis Tracks.

In all three options, the didactic coursework may include up to, but no more than, 3 s.h. of ENGR 9182 Independent Study I or 3 s.h. of MEE 9991 Directed Research. Furthermore, students who wish to take graduate coursework in Temple University schools/colleges other than the College of Engineering will need to obtain the appropriate written approvals on their Plan of Study form.

**Culminating Events:** Depends on the student's choice of track: Thesis, Project, or Coursework.

**Thesis Option:**
The master's thesis is the culminating event in the Thesis Track and is typically undertaken during the last two successive terms of study. Successful completion requires the following:

1. **Thesis Proposal — MEE 9996 Thesis I (3 s.h.)**
The student assembles a committee of three or more faculty members, including her/his advisor, who is typically a full-time ME faculty member. The student's Plan of Study should be updated, if necessary, to indicate the advisor's name.

   Under the guidance of the advisor and committee, the student prepares a research proposal and presents her/his proposal in an open College-wide seminar. The student is responsible for scheduling the proposal and posting an announcement at least 10 business days in advance of this seminar. Ordinarily, the proposal seminar is immediately followed by a meeting of the student's advisory committee in which the student is closely questioned about the details and strategy of the proposed research. The proposal is then accepted by the committee, accepted by the committee with revisions, or rejected by the committee.

   The student's advisory committee also jointly determines the letter grade (A-F) for Thesis I at the end of the term. The student must pass Thesis I before registering for Thesis II. If the student fails Thesis I, s/he may either re-register for Thesis I in the next regular term and repeat the entire proposal process (noting that a second failure will result in automatic dismissal from the University) or consider switching to the Project or Coursework Track, with the relevant updating of the Plan of Study form.

2. **Thesis Defense — MEE 9996 Thesis II (3 s.h.)**
The student should register for Thesis II in the term that s/he is prepared 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 [http://www.temple.edu/grad/policies/gradpolicies.htm](http://www.temple.edu/grad/policies/gradpolicies.htm).) The student should provide her/his committee with a copy of the completed thesis at least two weeks before the date of the thesis defense.

   The thesis is scheduled during a regular academic term, including summer terms. It should not be scheduled during study days, final exams, or the breaks between terms. The student should arrange for, and post an announcement of, the thesis defense at least 10 business days in advance of the defense. Furthermore, if the student is to graduate in the same term that s/he defends the thesis, the defense should be scheduled no later than 30 days prior to the end of the term to allow for document revisions in keeping with Graduate School deadlines, as specified at [http://www.temple.edu/grad/documents/Dissertation-and-Thesis-Handbook.pdf](http://www.temple.edu/grad/documents/Dissertation-and-Thesis-Handbook.pdf).

   The thesis defense is an open College seminar in which the student presents the concepts and results of her/his research. Normally, this presentation is immediately followed by a meeting of the thesis committee, which closely examines the student's research. The committee can accept the thesis as provided, accept the thesis with revisions, or not accept the thesis. If the thesis is accepted, the committee jointly decides on a letter grade for Thesis II. If the thesis is not accepted, but the committee decides to not fail the student:
   a. an "R" grade is assigned to Thesis II;
   b. the student registers in each subsequent term for one credit of ENGR 9991 Directed Research until s/he is again prepared to attempt the defense; and
   c. the entire open-seminar defense procedure described above is carried out in the term that the student is prepared to defend the thesis.

**Project Option:**
The project is the culminating event in the Project Track. It is normally carried out in the student's last term of study. The student selects an advisor (usually a full-time faculty member in the ME Department), registers for MEE 9995 Project, and conducts a one-term research activity under the supervision of the advisor. 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 jointly determined by the advisor and a second grader selected by the ME Graduate Program Director, as recorded in the Plan of Study.

**Coursework Option:**
No culminating event is warranted for the Coursework Track.

**Contacts**

**Program Web Address:**
http://engineering.temple.edu/graduate-programs/ms-mechanical-engineering
Department Information:
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Courses
MEE 5110. Special Topics. 3 Credit Hours.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.
Repeatability: This course may be repeated for additional credit.

MEE 5117. Finite Element Analysis. 3 Credit Hours.
Concepts and techniques of finite element and finite difference methods; mesh generation techniques; computer graphics presentation methods. Application to solids, liquids, and gases in the areas of stress, strain, deflection elasticity, heat transfer, fluid flow, and combustion.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.
Repeatability: This course may not be repeated for additional credits.

MEE 5201. Thermodynamics of Materials. 3 Credit Hours.
An introductory master's level course that explores materials from a thermodynamic perspective: Includes the laws of thermodynamics, free energy, chemical potential, stability, etc. A detailed analysis of phase diagrams is presented in the second half of the course.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.
Repeatability: This course may not be repeated for additional credits.

MEE 5203. Advanced Materials Science. 3 Credit Hours.
Chemical bonding, crystallography, defects and their effects on material properties, nucleation, growth, and microstructure development.
Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.
Repeatability: This course may not be repeated for additional credits.
MEE 5204. Solid State Physics for Material Science. 3 Credit Hours.
Crystal structures, bonding, crystal binding energies, reciprocal lattice, elastic properties, phonons, thermal properties, electronic properties, energy bands, band structures, semiconductors, doping, carrier concentration, fermi surfaces, metals, excitation, optical properties, electron scattering, carrier transport, impurities, defects, surfaces, interfaces.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5205. Microscopy and Microanalysis of Materials. 3 Credit Hours.
This course will cover various Microscopy and Microanalysis techniques which are widely used in research labs and in industries to characterize micro and nano structure and chemical composition of solid matter. Among them are visual light, scanning probe and electron beam microscopy and associated spectroscopy. The primary focus will be on fundamental aspects and experimental methods of Scanning Electron Microscopy (SEM) and associated spectroscopy. The SEM facility will be used for individual student projects. Particular attention will be given to the selection criteria used for choosing the appropriate technique for materials characterization.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5312. Mechanics of Composite Materials. 3 Credit Hours.
Introduction to the behavior of composite materials and their use in engineering structures: behavior and properties of the constituent fibers and matrices, micromechanical predictions of composite properties, anisotropic elasticity, behavior of composite laminae, classical lamination theory; fracture mechanisms, failure theories; behavior of composite plates and beams.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5411. Introduction to Mobile Robotics. 3 Credit Hours.
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).

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5511. Thermodynamic Properties. 3 Credit Hours.
Review of quantum mechanics and introduction to statistical mechanics. Statistical thermodynamics and various models of matter. Accuracy and trends of the predicted properties of various materials.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5512. Compressible Fluid Dynamics. 3 Credit Hours.
This course introduces students to the subject of high speed gas dynamics. Compressible flows exhibit fundamentally different behavior from those in low speed, constant density fluids. Such flows are found in aerodynamics, combustors, turbines, jets, gas pipelines, and wind tunnel facilities. Students study phenomena associated with supersonic flows, including normal and oblique shocks, expansion fans, and compressible flows with friction and/or heat transfer. An introduction to high temperature and rarified gas dynamics is also included.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.
MEE 5575. Renewable and Alternative Energy. 3 Credit Hours.
The objective of the course is to establish the theoretical basis for the description of regular and chaotic dynamic systems. Students learn to understand the basic ideas of dynamic systems and the nature of chaotic behavior so they can apply these ideas to particular systems. They also learn how to choose the appropriate modeling techniques and hypothesis to establish a mathematical model of a qualitatively described phenomenon. Discussed applications include examples from fluid mechanics, physics, and biology.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5576. Photovoltaic Syst Design. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5577. Power Generation and Storage Technologies. 3 Credit Hours.
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.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5731. Cardiovascular Fluid Dynamics. 3 Credit Hours.
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.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5732. Tissue Biomechanics. 3 Credit Hours.
Tissue Biomechanics course is an introductory course about the mechanical properties of living tissues. The emphasis of the course is on the meaning of constitutive models for bio-solids and bio-fluids. Topics include a review of elastic, viscous, and viscoelastic constitutive models; bioviscoelastic solids; mechanical properties of blood vessels; mechanics of skeletal and heart muscles.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5733. Viscoelasticity. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 5734. Forensic Engineering. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 8110. Special Topics. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

MEE 8315. Fracture Mechanics. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

MEE 9182. Independent Study I. 3 Credit Hours.
Special study in a particular aspect of engineering under the direct supervision of a graduate faculty member. May be taken once by MS/MSE students and once by Ph.D. students.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.
MEE 9282. Independent Study II. 3 Credit Hours.
Special study in a particular aspect of engineering under the direct supervision of a graduate faculty member. May be taken once by Ph.D. students.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

MEE 9991. Directed Research. 1 to 6 Credit Hour.
Under the guidance of a faculty member, the student will conduct independent research on a selected topic in engineering.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

MEE 9994. Preliminary Examination Preparation. 1 to 6 Credit Hour.
This course is intended for Ph.D. students who have completed their coursework but who have not yet passed both the Ph.D. Preliminary Examination.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

MEE 9995. Project. 1 to 3 Credit Hour.
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.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

MEE 9996. Thesis. 1 to 3 Credit Hour.
Master's thesis. May be taken twice.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

MEE 9998. Pre-Dissertation Research. 1 to 6 Credit Hour.
This course is intended for Ph.D. students who have passed both the Preliminary and Qualifying Examinations but who have not been elevated to candidacy.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

MEE 9999. Dissertation Research. 1 to 6 Credit Hour.
This course is intended only for those students who have achieved Ph.D. Candidacy status. A minimum of 6 semester hours is required for graduation.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Student Attribute Restrictions: Must be enrolled in one of the following Student Attributes: Dissertation Writing Student.

Repeatability: This course may be repeated for additional credit.