

---

## Graduate Programs in Mechanical Engineering

**March 2008**

The information in this brochure was accurate at the time of publication. Minor program changes may have occurred since then. If you have questions, write or phone the Department Graduate Programs Director.

### **FOR MORE INFORMATION:**

Department of Mechanical and  
Aeronautical Engineering  
College of Engineering and Applied Sciences  
F-234 Parkview Campus  
Western Michigan University  
1903 W. Michigan Ave.  
Kalamazoo, MI 49008-5343  
269 276-3420  
Fax: 269 276-3421  
[www.wmich.edu/mae](http://www.wmich.edu/mae)

Department Chair  
Dr. Parviz Merati  
269 276-3420

Graduate Programs Director  
Dr. Koorosh Naghshineh  
269 276-3431  
[Koorosh.naghshineh@wmich.edu](mailto:Koorosh.naghshineh@wmich.edu)

Office of Admissions and Orientation  
269 387-2000  
[www.wmich.edu/admi](http://www.wmich.edu/admi)

Office of International Student Services  
269 387-5865  
[www.international.wmich.edu](http://www.international.wmich.edu)

Western Michigan University  
269 387-1000  
[www.wmich.edu](http://www.wmich.edu)

It is the policy and commitment of Western Michigan University not to discriminate on the basis of race, sex, age, color, national origin, height, weight, marital status, sexual orientation, religion, handicap, or veteran status in its educational programs, activities, admissions, or employment policies in accordance with Title VII of the Civil Rights Act of 1964, Title IX of the 1972 Education Amendments, Executive Order 11246 as amended, Section 504 of the Rehabilitation Act of 1973, and all other pertinent state and federal regulations.

---

# The Master of Engineering in Mechanical Engineering

Graduates with the Master of Science in Engineering (Mechanical) look forward to career opportunities at higher levels of responsibility. The areas of opportunities include, but are not limited to, mechanical system, structural dynamics, system design and controls, materials, experimental stress analysis, vehicle dynamics, experimental and computational fluid dynamics, thermal and power systems, fuel cells, noise and vibrations, finite element analysis, and micro and nano-technology. Opportunities for mechanical engineers continue to develop with the rapid expansion of the knowledge base.

Class sequencing and scheduling (in the evening hours) are arranged so that a working engineer can complete the program in three years while maintaining full-time employment.

## Admission Requirements

1. Bachelor of Science in Mechanical Engineering from an institution with an ABET/EAC accredited program.
2. Submit results of the Graduate Record Examination (GRE).

Applicants with degrees in other engineering fields or related disciplines may be considered for admission after they have satisfactorily completed the necessary undergraduate prerequisite courses prescribed by the department's graduate advisor. Based on Graduate Advisor's discretion, these courses can be all or a subset of ME 2320, 2500, 2560, 2570, 2580, 3560, 3650, 4310, 4320, MATH 2720, 3740.

Probationary admission may be granted to a student with a baccalaureate degree and less than the required academic record or anyone having a baccalaureate degree from a non-accredited college or anyone needing more than three prerequisite courses. A student admitted on non-degree probationary status may establish eligibility for regular admission by completing the specified prerequisite courses, and securing grades of "B" or better in each course in the first twelve hours of graduate work.

A student with a baccalaureate degree who wishes to enroll in courses but does not plan to pursue a program leading to a master's degree, or is not eligible for regular admission may enroll in courses for which prerequisite requirements are satisfied with Guest status. If the student later decides to apply for regular admission, no more than nine hours of work taken under Guest status will be considered part of a degree program.

## Program Options and Requirements

Students may choose the Thesis Option or the Non-Thesis Option as described below. A specific program of study for each student is determined in conjunction with and subject to approval of the student's advisor.

### Thesis Option

---

This option of the Master of Science in Engineering (Mechanical) consists of thirty hours, of which six must be taken as thesis.

#### 1. A minimum of thirty (30) semester hours of credit

Including eighteen (18) hours of approved courses in the area of mechanical engineering, six (6) hours of electives, and six (6) hours of thesis research. A maximum of 15 of the 30 credits may be 5000 level courses.

#### 2. A minimum of six (6) hours must be mathematics oriented.

The mathematics-oriented courses may include mechanical engineering courses (e.g., ME 5600, 5610, 5620, 6370, and 6610) or electives selected from any engineering department in the College of Engineering and Applied Sciences, or in mathematics, computer science, and the physical sciences. Students who choose to take a class outside the ME approved list of graduate courses must obtain the approval of the ME graduate advisor prior to registering for such classes.

#### 3. Satisfactory completion of six (6) hours of ME 7000 (Master's Thesis) under the guidance of the thesis advisor and committee

### Non-Thesis Option

---

This option of the Master of Science in Engineering (Mechanical) consists of thirty-six (36) hours, of which up to six may be taken as project.

#### 1. A minimum of thirty-six (36) semester hours of credit

Including thirty (30) hours of approved courses in the area of mechanical engineering plus six (6) hours of electives. A maximum of 18 of the 36 credits may be 5000 level courses.

#### 2. A minimum of six (6) hours must be mathematics oriented.

The mathematics-oriented courses may include mechanical engineering courses (e.g., ME 5600, 5610, 5620, 6370, and 6610) or electives selected from any engineering department in the College of Engineering and Applied Sciences, or in mathematics, computer science, and the physical sciences. Students who choose to take a class outside the ME approved list of graduate courses must obtain the approval of the ME graduate advisor prior to registering for such classes.

#### 3. Up to six (6) hours of ME 6970 (Problems in Mechanical Engineering) may be taken as part of the thirty (30) hours of approved courses in the area of mechanical engineering for research conducted under the supervision of a department faculty member

---

# The Doctor of Philosophy in Mechanical Engineering

The Doctor of Philosophy in Mechanical Engineering is designed to intensify the knowledge and comprehension of the student in the various disciplines of the subject, with emphasis on original research in a chosen area of specialty.

## Admission Requirements

In addition to the general admission requirements for a doctoral degree at Western Michigan University, a Master of Science in Mechanical Engineering or a related engineering discipline will be required. Students with a Master of Science in mathematics or in a natural science discipline may also be admitted if they have a Bachelor of Science in Mechanical Engineering or a related engineering discipline. The Master of Science should be from a university recognized and approved by the Graduate Committee of the department. Evidence of scholarship and potential for independent research in mechanical engineering must be presented along with the application. The level of achievement in mathematics, physics, and chemistry courses, which are prerequisites for success in doctoral studies in engineering, will also be considered in evaluating the application. The applicant must also submit the results of the verbal, analytical, quantitative, and engineering portions of the Graduate Record Examination (GRE). In addition, a Statement of Purpose outlining the student's research interest along with three letters of reference from persons who can assess the student's potential as a researcher must be submitted. All students are required to contact department faculty members who are active in the student's area of research interest and secure a faculty member's help in supervising their doctoral research. It is the policy of the Mechanical and Aeronautical Engineering department not to admit doctoral students unless a member of the department faculty has agreed to serve as their mentor.

## Program Requirements

The doctor of philosophy program in mechanical engineering at Western Michigan University is designed to meet the needs of engineers who are planning a career in academia or in governmental or industrial research centers.

The main accomplishment of the Ph.D. student should be an original, high quality research. The program is oriented toward that achievement. The course work and number of credit hours that a student will be required to take depend on the individual qualifications, level of preparation for independent research, and the needs for successful accomplishment of the dissertation. It allows a full-time student entering with a master of science in mechanical engineering to complete all degree requirements within three years. It is not uncommon, however, for doctoral programs to take somewhat longer.

Ph.D. program applicants are expected to meet the entrance requirements of WMU's Graduate College and to demonstrate that they have an interest in, and aptitude for conducting independent research. The program requires:

- Specialization in one of the fundamental areas of mechanical engineering
- Independent research that is publishable in a peer-reviewed engineering journal

The doctoral student must acquire through course work and demonstrate in a qualifying examination a broad knowledge and understanding of mathematics and two of the following core areas of mechanical engineering: thermodynamics and heat transfer; fluid mechanics; structural mechanics; materials; control systems; and dynamics and vibrations. Prior to taking the qualifying examination, the student must obtain approval from the advisor to proceed with the examination. Intensive and successful use of a required area of competency in the research work must be approved by the dissertation committee.

Beyond the master's degree, the Ph.D. requires:

- At least 45 graduate credit hours for graduation, including 18 credits of course work, 12 credits of preparatory and independent research, and 15 credits of dissertation (ME 7300).
- At least 18 non-dissertation credits taken from the Department of Mechanical and Aeronautical Engineering. Courses from other departments must be pre-approved by the dissertation faculty adviser
- Ph.D. credit will be given for MAE department 5000 level courses only in the special circumstance that the specific course is a pre-requisite for 6000 or 7000 level courses subsequently taken by the student, or is required by the doctoral committee (see the list of approved courses)
- A minimum grade point average of 3.25, with no grade below a "B" included in the 45 graduate credit hours required for graduation
- A one-year residency
- Successful completion of a qualifier examination in mathematics and core mechanical engineering areas.
- Successful completion of the specialty exam
- Successful completion of doctoral defense

Details of the Ph.D. study process may be obtained from the Department Graduate Programs Director or the webpage of the Department of Mechanical and Aeronautical Engineering located at <http://www.wmich.edu/mae>.

---

## Graduate Course Offerings:

The following is a list of the graduate courses currently offered by the department of Mechanical and Aeronautical Engineering.

Course	Description	Course	Description
ME 5300	Theoretical & Comp. Fluid Mech.	ME 6320	Energy Resources and Conversion
ME 5350	Applied Spectroscopy	ME 6330	Advanced Control Systems
ME 5390	Advanced Thermal Design	ME 6340	Digital Flight Control Systems
ME 5400	Automatic Control of Flight Vehicles	ME 6350	Turbulence
ME 5410	Continuous System Modeling & Simulation	ME 6360	Optical Measurement Methods
ME 5450	Computational Fluid Dynamics I	ME 6370	Design Optimization
ME 5500	Material Science II	ME 6450	Computational Fluid Dynamics II
ME 5530	Advanced Product Design	ME 6510	Advanced Strength of Materials
ME 5550	Intermediate Dynamics	ME 6520	Mechanics of Composites
ME 5580	Mechanical Vibrations	ME 6530	Fatigue of Engineering Materials
ME 5600	Engineering Analysis	ME 6540	Composite Materials
ME 5610	The Finite Element Method	ME 6550	Advanced Material Science
ME 5620	Numerical Methods in Engineering	ME 6551	Precision Machining and Micromanufacturing
ME 5640	Engineering Noise Control	ME 6555	Nanofabrication Technology
ME 5690	Principles of Fatigue and Fracture	ME 6580	Similarities in Structural Dynamics
ME 5710	Gas Dynamics	ME 6590	Multi-Body Dynamics
ME 5720	Advanced Thermodynamics	ME 6610	Advanced Finite Elements
ME 5730	Engineering Materials	ME 6630	Structural Vibrations
ME 5750	Tribology	ME 6640	Acoustics
ME 5770	Fuel Cell and Alternative Energy	ME 6650	Sound and Structure Interaction
ME 6090	Combustion	ME 6690	Engineering Fracture Mechanics
ME 6210	Theory of Plates and Shells	ME 6710	Conduction
ME 6220	Stability of Thin-walled Structures	ME 6720	Convection & Radiation
ME 6300	Advanced Fluid Dynamics	ME 6730	Power Plant Design
		ME 6760	Phase Change Phenomena

---

## Facilities

WMU's College of Engineering and Applied Sciences is located at the heart of the University's Parkview Campus. The 343,000-square-foot facility was completed in the fall of 2003. The \$72.5 million high-tech academic building is the University's largest. The new facility includes seven computer teaching labs, 75 research and teaching laboratories, and a number of flexible classroom and lecture spaces. Many features are aimed specifically at student study and research needs, including study lounges and breakout rooms where small groups can work together on engineering projects. The facility is a wireless computing environment, but also includes extensive hard wiring for high-end computing needs and interactive instruction.

## The department

The Department of Mechanical and Aeronautical Engineering continues to expand to meet changing technological and educational needs. It supports a balanced approach to teaching and research, and graduates of its programs are prepared to make a strong contribution to either industry or academia.

The department contains state-of-the-art laboratories. A listing of these laboratories along with the name of the faculty member responsible for each lab is given below.

- Applied Aerodynamics (Liu)
- Fluid Mechanics (Merati)
- Computational Fluid Dynamics (Liou)
- Heat Transfer (Cho)
- Advanced Thermal Systems (Lee)
- Alternative Energy & Fuel Cell (Shrestha)
- Coherent Optics (Hathaway)
- Mechanical Behavior of Materials (Kujawski)
- Advanced Material Testing and Evaluation (Kujawski)
- Noise and Vibration (Naghshineh)
- Material Science (P. Ari-Gur)
- Motion and Control (Kamman)
- Vehicle Design Center (Hathaway)
- Instrumentation (Ghantasala)
- Micro/Nano Fabrication (Ghantasala)
- Tribology (Patten)
- Optical Diagnostics (Fajardo)
- Automotive Testing (Fajardo, Hathaway, Shrestha)

---

## The faculty

Most faculty members hold terminal degrees in mechanical engineering or closely related fields. Their areas of research include but are not limited to mechanical system, structural dynamics, system design and controls, materials, experimental stress analysis, vehicle dynamics, experimental and computational fluid dynamics, thermal and power systems, fuel cells, noise and vibrations, finite element analysis, and micro and nano-technology.

### Department Chair

#### **Parviz Merati, P.E.**

Ph.D., Theoretical and Applied Mechanics, University of Illinois at Urbana-Champaign  
Areas of expertise: experimental and computational fluid mechanics and heat transfer, compressible fluid flow, tribology  
Address: F260 Parkview  
Phone: 269 276-3420

### Graduate Programs Director

#### **Koorosh Naghshineh, P.E.**

Ph.D., Mechanical Engineering, Pennsylvania State University  
Areas of expertise: acoustics, vibrations, active noise and vibration control  
Address: G226 Parkview  
Phone: 269 276-3431

### Other Faculty

#### **Judah Ari-Gur**

D.Sc., Aeronautical Engineering, Technion (Israel)  
Areas of expertise: structural dynamics, blast response of shells, structural stability, composite material structures, finite-element modeling

#### **Pnina Ari-Gur**

D.Sc., Materials Engineering, Technion (Israel)  
Areas of expertise: nano-composites, ferromagnetic shape memory alloys, nano-ceramics

#### **Christopher Cho, P.E.**

Ph.D., Mechanical Engineering, State University of New York at Stony Brook  
Areas of expertise: heat transfer, two-phase flow, thermal-fluid measurement

#### **Claudia Fajardo**

Ph.D., Mechanical Engineering, University of Michigan  
Areas of expertise: Experimental fluid mechanics and combustion, optical diagnostics, internal combustion engines

#### **Muralidhar K. Ghantasala**

Ph. D., Instrumentation Engineering, Indian Institute of Science, Bangalore, India.  
Areas of expertise: micro/nano sensors and actuators, micro/nano fabrication technologies, high efficiency hybrid micro actuators

#### **Richard B. Hathaway, P.E.**

Ph.D., Systems Engineering, Oakland University  
Areas of expertise: vehicle structures and dynamics, engineering applications of optical methods

#### **James W. Kamman**

Ph.D., Engineering Science, University of Cincinnati  
Areas of expertise: mechanical system dynamics and control, towed marine system dynamics, and multibody dynamics

#### **Daniel Kujawski**

D.Sc., Mechanics of Solids, Warsaw University of Technology;  
Ph.D., Mechanics of Solids, Polish Academy of Sciences  
Areas of expertise: fatigue and fracture, life prediction, and mechanical testing

#### **Ho Sung Lee**

Ph. D., Mechanical engineering, University of Michigan  
Areas of expertise: heat transfer, thermal design, boiling in microgravity, and engine cooling systems

#### **William W. Liou**

Ph.D., Aerospace Engineering, Pennsylvania State University  
Areas of expertise: continuum and discrete fluid flow simulations, transition and turbulence, aerodynamics, and propulsion

#### **Tianshu Liu**

Ph.D., Aeronautics and Astronautics, Purdue University  
Areas of expertise: Experimental Aerodynamics, Applied Aerodynamics, Fluid Mechanics, Heat Transfer

#### **Kapseong Ro**

Ph. D., Aerospace engineering, University of Maryland at College Park  
Areas of expertise: Aircraft flight dynamics and control, flight simulation, unmanned aerial vehicle

#### **Iskender Sahin, P.E.**

Ph.D., Aerospace and Ocean Engineering, Virginia Polytechnic Institute and State University  
Areas of expertise: computational fluid dynamics and heat transfer; marine hydrodynamics, stability and transition

#### **Rameshwar Sharma**

Ph.D., Mechanical Engineering, Wayne State University  
Areas of expertise: system design and controls, internal combustion engines, and numerical methods simulation

#### **Bade Shrestha, P.E.**

Ph. D., Mechanical Engineering, University of Calgary  
Areas of expertise: alternative fuel combustion, advance internal combustion engines, fuel cells, and renewable and sustainable energy development

#### **Edmund Tsang**

Ph. D., Metallurgy, Iowa State University  
Areas of expertise: service-learning in engineering, k-12 outreach, ABET assessment and accreditation

#### **Dennis VandenBrink, P.E.**

Ph.D., Engineering Mechanics, Virginia Polytechnic Institute and State University  
Areas of expertise: finite-element analysis, stress analysis, system dynamics