

MECHANICAL ENGINEERING (ENME)

Graduate Degree Program
College: Engineering

Abstract

The Department of Mechanical Engineering offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. In addition, students may pursue a Master of Engineering degree through the Professional Master's Program of the Office of Advanced Engineering Education. The Department's instruction and research are carried out through the following areas:

DESIGN and System Reliability

The focus of this area of concentration is the study of:

- Measuring, tracking, and predicting levels of reliability during systems' life cycles
- Understanding and mitigating the causes of component, system, and process failures
- Incorporating reliability, sustainment, and life-cycle considerations into design
- Microelectronic device and electronic system reliability and stress analysis
- Integrated product design and manufacturing
- Design and reliability of high temperature and high power electronic systems, electro-optics, sensors, and actuators
- Battery design, thermal management, and reliability
- Design formalisms
- Multi-criteria design decision making and optimization
- Statistical process control and improved manufacturing methods
- Human reliability analysis
- Cybersecurity
- Machine learning and data analytics

Mechanics, Materials, and manufacturing

This division concentrates on the study of analytical and experimental fundamentals of mechanics and materials. Areas of specialization include:

- Control systems in product development organization
- Dynamic deformation and fracture studies, including fracture and fragmentation by explosives
- Fiber optics
- Smart structures
- Vibration and acoustic control
- Vibro-acoustic heating and phonon transport
- Non-linear dynamics of milling of thin walled structures
- Control of crane-load oscillations
- Surgical robotics
- Development of creep-fatigue damage models for viscoplastic materials such as solder
- Micromechanics of advanced composite materials

- Characterization and optimization of mechanical properties of materials
- Methods for non-destructive detection of damage in structural systems
- Mechanical characterization of Micro-Electro-Mechanical Systems (MEMS) materials
- Manufacturing systems
- Additive manufacturing in micro-nano-bio systems

Thermal, Fluids, and Energy Sciences

This division encompasses two broad disciplines: thermal science and fluid mechanics. Areas of specialization include:

- Application of three-dimensional vortex methods to turbulent flow prediction
- Experimental, numerical, and theoretical analysis of scalar pollutant dispersion in turbulent boundary layers
- Experimental studies of the near surface atmospheric boundary layer
- Large-eddy and direct numerical simulation of 3-D and non-equilibrium boundary layers
- Experimental measurement and analysis of particle/turbulence interaction within turbulent, multi-phase flows
- Fundamental research into pool and flow boiling heat transfer
- Experimental investigation of steady and unsteady breaking waves
- Fouling and particulate deposition on low temperature surfaces
- Performance of water foaming agents in fire protection applications
- Mixing of boron diluted water slugs and nuclear reactor reactivity excursions
- Thermal management and characterization of electronic equipment
- Transport phenomena in manufacturing
- Study of absorption heat pumps and chillers
- Heat transfer enhancement of environmentally safe refrigerants
- Investigation of performance potential for natural refrigerant
- Simulation, analysis, and experimentation in heat pump and refrigeration systems
- Annular and post-annular flow in microchannels
- Two-phase thermofluid enhancement through flow regime modification
- Monolithic and thin-film thermoelectric microcoolers.

Financial Assistance

Financial assistance is available to highly qualified students in the form of research and teaching assistantships. The most outstanding applicants are offered fellowships. Students seeking financial assistance should submit with their applications a current resume or CV as well as a statement regarding their qualifications and/or past research or teaching experience. Financial assistance is sought for all worthy students.

Contact

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Website: <http://www.enme.umd.edu>

Courses: ENME (<https://umd-curr.courseleaf.com/graduate/courses/enme/>) ENRE (<https://umd-curr.courseleaf.com/graduate/courses/enre/>)

ADMISSIONS

General Requirements

- Statement of Purpose
- Transcript(s)
- TOEFL/IELTS/PTE (international graduate students (<https://gradschool.umd.edu/admissions/english-language-proficiency-requirements/>))

Program-Specific Requirements

- Letters of Recommendation (3)
- Graduate Record Examination (GRE) (optional)
- CV/Resume
- Description of Research/Work Experience (optional)
- Writing Sample (optional)

The programs leading to the M.S. and Ph.D. degrees are open to qualified students holding a bachelor's degree in mechanical engineering. Admission may also be granted to students with degrees from other

areas of engineering, mathematics, and physical sciences. In some cases, students may be required to take undergraduate courses to fill gaps in their background.

Application Deadlines

Type of Applicant	Fall Deadline	Spring Deadline	Summer Deadline
Domestic Applicants			
US Citizens and Permanent Residents	May 8, 2026	October 10, 2025	May 15, 2026 (MS only)
International Applicants			
F (student) or J (exchange visitor) visas; A, E, G, H, I and L visas and immigrants	March 6, 2026	September 19, 2025	N/A

RESOURCES AND LINKS:

Program Website: <http://www.enme.umd.edu>

Application Process: gradschool.umd.edu/admissions/application-process/step-step-guide-applying (<https://gradschool.umd.edu/admissions/application-process/step-step-guide-applying/>)

REQUIREMENTS

- Mechanical Engineering, Doctor of Philosophy (Ph.D.) (<https://academiccatalog.umd.edu/graduate/programs/mechanical-engineering-enme/mechanical-engineering-phd/>)
- Mechanical Engineering, Master of Science (M.S.) (<https://academiccatalog.umd.edu/graduate/programs/mechanical-engineering-enme/mechanical-engineering-ms/>)

FACILITIES AND SPECIAL RESOURCES

Mechanical engineering faculty, researchers, and students leverage state-of-the-art research equipment, technology, and systems to develop new methods, create innovative tools, and find practical solutions to the most pressing societal concerns. More information about our research labs and centers can be found here: <https://enme.umd.edu/facilities> (<https://enme.umd.edu/facilities/>).