UNIVERSITY OF DETROIT MERCY

We Want Great Things for You

MASTER/DOCTOR OF ENGINEERING IN MECHANICAL ENGINEERING

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Master of Science in Mechanical Engineering and Doctor of Engineering

The Mechanical Engineering graduate program is student-centered, providing high-quality instruction in both theory and the latest engineering developments. All our full-time faculty hold doctorates in engineering, and most bring significant industrial experience to the classroom. For the working person, all our classes are held in the late afternoon and evening. Many of our full-time graduate students obtain paid internships in local industry for one or two terms during their course of study.

The Mechanical Engineering Department prides itself on the care and concern we provide to our students. Our graduates are prepared for a rewarding and exciting career in a wide variety of industries.

Admission Requirements

Admission to UDM Engineering programs requires an undergraduate degree in engineering with a minimum GPA of 3.0 on a 4.0 scale. GRE and TOEFL are not required for admission but may be helpful. However, international students are required to take an English exam to determine if they need English language classes.

Degree Requirements

The Master of Engineering in Mechanical Engineering may be completed through either a thesis or non-thesis plan. The thesis plan includes 24 credit hours of course work and six credit hours of thesis. The non-thesis plan consists of 30 credit hours of course work plus a 3-credit hour capstone design course. The project-based design course assesses the student's ability to synthesize material covered in the graduate curriculum.

The doctoral program requires 51 credit hours of coursework beyond the engineering baccalaureate. Additionally, 36 credit hours of dissertation are required.

All students are required to take at least one advanced mathematics course. Highly recommended are ENGR 5300 (Advanced Engineering Mathematics) or MTH 5270 (Probability and Statistics). Design of Experiments (ENGR 5020) is also required of all students. Each student must choose one of the following four concentrations and take at least two courses within that concentration:

Transportation Systems Concentration

MENG 5340 Finite Element Analysis
MENG 5580 Internal Combustion Engines I
MENG 5590 Internal Combustion Engines II
MENG 5720 Noise Vibration & Harshness
MENG 5760 Vehicle Dynamics

Manufacturing Systems Concentration

MENG 5300 Advanced Metal Cutting
MENG 5320 Advanced Metal Forming
MENG 5940 Manufacturing Systems
MENG 5900 Robotics

Mechatronics Systems Concentration

ENGR 5780 Mechatronics
ENGR 5790 Mechatronics: Simulation and Modeling
ENGR 5520 Sensors and Actuators
MENG 5900 Robotics

Thermal Systems and Alternative Energy Conversion Concentration

ENGR 5040 Conductivity
ENGR 5080 Computational Fluid Dynamics
ENGR 5480 Advanced Fluid Mechanics
MENG 5810 Alternative Energy Systems

Additional information, including a list and description of all graduate courses offered, can be found at:
http://eng-sci.udmercy.edu/mengr/index.html
http://www.udmercy.edu/catalog/ and
http://www.udmercy.edu/

For further information, please write, call or e-mail:

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International Students: contact Steven Coddington at coddinsm@udmercy.edu

Courses Descriptions on the above-mentioned

ENGR 5040 Conductivity **3 cr.**
(Prerequisite: ENGR 3400). An in-depth analysis of conduction heat transfer. Topics include: derivation of the heat conduction equation, application of boundary conditions, and analytical and approximate solutions to the governing partial differential equations. A dual emphasis is placed on understanding the fundamentals and modeling real-world problems.

ENGR 5080 Computational Fluid Dynamics **3 cr.**
(Prerequisite: ENGR 3140 and ENGR 340). An introduction to numerical solution of the continuity, momentum, and energy equations. Topics include: numerical solutions of the heat conduction equation, boundary-layer equations, lubrication equations, Stokes equations, Navier-Stokes equations, and energy equation. Emphasis is placed on finite difference solutions, but other solution techniques are touched upon. Students are also exposed to modeling with a commercial CFD package.

ENGR 5480 Advanced Fluid Mechanics **3 cr.**
(Prerequisite: ENGR 3140 or equivalent). Ideal Fluids. Basic principles and equations of motion and continuity. Potential flow, velocity potential and stream function. Standard flow types and superposition. Complex variables, conformal mapping. Schwarz Christoffel transformations and free stream lines. Viscous fluids and derivation of Navier-Strokes equations. Boundary layer theory. Flow in porous media. Introduction to turbulence.

ENGR 5520 Sensors & Actuators **3 cr.**
Study of fundamental transduction mechanisms of common sensors and actuators. Principles of data acquisitions. Use of software tools for data interaction with sensors and actuators. Introduction to micro electro-mechanical systems (MEMs). A key component of this course will be laboratory exercises involving sensors and actuators.

ENGR 5780 Mechatronics **3 cr.**
Principles, components, and design of mechatronic systems, including modeling and simulation, sensors, actuators, control strategies, and instrumentation. These topics are explored in the context of a group project.

ENGR 5790 Mechatronics: Simulation & Modeling **3 cr.**
Analysis, Synthesis and Design of Mechatronic Systems through the use of modeling and simulation tools. Use will be made of a unified energy flow approach to model mechatronic systems that comprise of multi-disciplinary components. Computer simulation exercises to enhance student learning will be a key component of this course.

MENG 5300 Advanced Metal Cutting **3 cr.**
An application of elastic and plastic theories is used to discuss advanced topics in metal cutting. These include machine tool operations, mechanics of cutting forces and power in cutting, tool wear and tool life. Economics of machining and cutting temperatures, current trends in machining are discussed.

MENG 5320 Advanced Metal Forming **3 cr.**
Formability of materials is discussed using plastic theories and dependence of flow stress or strain, strain rate and anisotropy. These principles are used to discuss sheet metal forming and bulk deformation processes. The topic is enhanced with computer-aided design of forming operation. Recent developments in forming.

MENG 5340 Finite Element Analysis **3 cr.**
(Prerequisite: ENGR 4420). A study of finite element as a numerical technique for solving engineering problems. Variational and weighted residual approach. Transient problems. Two-dimensional and higher order elements. Isoparametric elements. Introduction to non-linear problems. Several computer projects related within manufacturing and automotive applications will be required.

MENG 5580 Internal Combustion Engines **3 cr.**
The application of principles of chemistry and thermodynamics to the theory and design of gas power engines. The concepts of spark ignition, compression ignition, cycle analysis and combustion characteristics are treated in-depth.

MENG 5590 Internal Combustion Engines II 3 cr.
Prerequisites: MENG 5580
The continuation of the theory and design of gas power engines. Particular attention is given to detailed design considerations. The effects of changes in engine parameters on fuel economy, performance and emissions are studied.

MENG 5720 Noise Vibration & Harshness 3 cr.
(Prerequisite: ENGR 3130 and MTH 3720). An overview of problems in acoustics and vibration control. The use of single and multiple degree of freedom-lumped parameter systems are used to describe systems. Method for controlling noise and vibration sources are discussed.

MENG 5760 Vehicle Dynamics 3 cr.
(Prerequisite: ENGR 3130 and MTH 3720). The stability and control of vehicles in the accelerating and decelerating modes along straight and curved paths. Special attention is given to the behavior and limitations of the pneumatic tire as applied to motor vehicle requirements.

MENG 5810 Alternative Energy Systems 3 cr.
Focus on alternatives to conventional energy systems for power generation, refrigeration, and transportation. Students will apply principles of thermodynamics, fluid mechanics, and other engineering disciplines to the analysis of solar, wind, nuclear, geothermal, tidal, and fuel cell power systems. An overview of global energy use and modeling will be presented. Other course topics include alternative fuels for transportation, new developments in energy storage, and the role of energy efficiency improvements in the achievement of a more equitable and sustainable global energy distribution. Environmental and economic issues surrounding the various alternatives will be addressed.

MENG 5900 Robotics 3 cr.
The modeling and analysis of robotic systems. Key topics include spatial description and transformations, forward and inverse kinematics, jacobians, dynamics, an introduction to machine vision, and task planning. Students program a robot to perform a task.

MENG 5940 Manufacturing Systems 3 cr.
(Prerequisite: Familiarity with personal computers and manufacturing systems). A topical review of systems technology in the manufacturing enterprise. The emphasis is on understanding how information is acquired and processed in manufacturing operations. Automatic Identification/Data Acquisition techniques such as one and two dimensional bar code are considered. Manufacturing Resource Planning and Product Data Management is reviewed. The course also examines Electronic Data Interchange and the Network/Communications technology that supports it. Projects are conducted in virtually all topic areas.