

**YOUNGSTOWN STATE UNIVERSITY  
DEPARTMENT OF MECHANICAL & INDUSTRIAL ENGINEERING  
MASTER OF SCIENCE IN ENGINEERING**

The College of Engineering and Technology offers a Graduate Program leading to the Master of Science degree in Engineering. Admission to any of the five engineering options (Chemical, Civil, Electrical and Computer, Industrial, and Mechanical Engineering) is granted to qualified applicants who have been judged to have a good chance of succeeding in the program and obtaining a graduate degree. Several technical concentration areas are available in each option. Students may select a thesis, non-thesis, management, or self-directed curriculum plan. Additionally, early placement plans for the Ph.D. or Doctorate degrees in engineering are available. These opportunities serve the practicing engineer as well as the student who wants to pursue advanced graduate study and research. Courses offered on-campus are usually scheduled during the evenings. The educational opportunities within the college include traditional classroom and laboratory courses, seminars, and research projects guided by members of the graduate faculty.

Teaching or Research Assistantship positions are available to qualified applicants upon review and recommendation by the home department. In addition, the School of Graduate Studies and Research may offer scholarships or grants-in-aid to qualified students. Students desiring assistantships or scholarships must submit an application to the School of Graduate Studies and Research by the specified deadlines.

This description explains admission and degree requirements, advising, and program plans. Information concerning course scheduling and prospective course offerings can be obtained from the College Graduate Studies web site, or the engineering department. Further assistance with any graduate matter may be obtained by telephone, e-mail, letter, or personal visit to the program option coordinator in the student's area of interest.

#### **ADMISSION REQUIREMENTS**

##### *For Degree Programs*

In addition to the general requirements for admission to the School of Graduate Studies and Research, the applicant must show an unrecalculated grade point average in undergraduate study of at least 2.75 (on a 4.0 scale) in their major course work. Applicants with lesser qualifications may be granted provisional graduate student status based on evaluation of their undergraduate records, scholastic records, and professional qualifications.

##### *For Nondegree Admission*

An applicant whose academic record does not meet the required standards for admission to a Master of Science degree program may apply for nondegree admission to the School of Graduate Studies and Research. Upon admission to the graduate program under nondegree status, the student will be given an opportunity to demonstrate his/her capability to successfully complete 6.9 semester hours with a 3.0 (on a 4.0 scale) or higher. Upon successful completion, the student may apply for admission to a specific engineering degree option to continue his/her study for the Master of Science in Engineering.

##### *Early Admission for Eligible Youngstown State University Undergraduates*

Undergraduate students at YSU who have no more than six semester hours remaining to complete their bachelor's degree may apply for admission to a graduate program of their interest. If the applicant is admitted to the graduate program, he or she may register in the graduate school to begin the graduate program while simultaneously completing baccalaureate work. Additionally, this option may make the student eligible for an assistantship or for scholarship support. For more information, consult the College Graduate Program Director.

#### **ADVISEMENT**

The College of Engineering and Technology requires an advisor for each individual graduate student. An advisor is recommended by the Graduate Program Director and assigned by the School of Graduate Studies and Research upon acceptance.

#### **DEGREE REQUIREMENTS**

The Master of Science in Engineering may be characterized as being both career oriented and self-directed and offers flexibility to accommodate the needs of every engineering graduate student. Graduate students enrolled in any of the Engineering graduate programs must complete 30 s.h. for the thesis plan, 33 s.h. for the non-thesis plan, or 36 s.h. for the management emphasis plan as follows:

#### **CORE REQUIREMENTS**

Every graduate student is required to complete a minimum number (depending on the plan selected) of the following engineering core courses. The core courses have been selected to provide each student with basic tools needed to function effectively in the professional work area.

ENGR 6920 Project Planning and Management 3 s.h.  
ENGR 6921 Engineering Statistics 3 s.h.  
ENGR 6922 Engineering Systems Analysis 3 s.h.  
ENGR 6923 Information Technology Tools for Engineers 3 s.h.  
ENGR 6924 Computer Based Tools for Engineers 3 s.h.  
ENGR 6925 Applied Environmental Management 3 s.h.

## PROGRAM PLANS

### *NON-THESIS PLAN*

A total of 33 s.h. of course work is required for this plan. Graduate students who choose this option should select an area of concentration from the list below. Courses for each area are listed in the description of the home department's program option. In addition to 12 s.h. of core courses, every student enrolled in this option is required to complete 15 s.h. of area concentration courses, a 3 s.h. elective course, and a 3 s.h. special project course. The elective course may be selected to enhance the chosen technical concentration, or to allow the student to add breadth to his/her background by taking a course in another area. A graduate student enrolled in a special project course will be required to defend the results of his/her project by giving a presentation to the College of Engineering and Technology faculty and students. For further information pertaining to this plan, the graduate student may contact the Graduate Program Option Coordinator of his/her home department. Suggested concentration areas include:

- General Civil & Environmental or Electrical & Computer Engineering
- General Industrial/Manufacturing or Mechanical Engineering
- General Chemical Engineering
- Solid/Structural Mechanics
- Environmental Engineering/Science
- Engineering Management
- Energy/Power Systems/Power Electronics
- Control Systems

### *THESIS PLAN*

Graduate students choosing this option are required to complete 30 s.h. of graduate course work. This generally consists of 9 s.h. of core courses, 15 s.h. of technical concentration courses, and 6 s.h. of thesis. This plan is strongly recommended for candidates who wish to continue their graduate studies beyond the master's degree. Recent baccalaureate degree students are also encouraged to pursue the thesis plan. The thesis provides first-hand experience with experimental design, literature searches, research methodology and technical report writing and can lead to a higher level of expertise in the chosen area of specialization.

### *MANAGEMENT PLAN*

Students who have been in the work arena and are moving into an engineering management role may wish to choose this plan. A total of 36 s.h. of course work is required for this plan. In addition to 12 s.h. of core courses, a series of engineering and business courses totaling 21 s.h. are recommended in the description of the home department's graduate program option. The student must also complete a 3 s.h. special project course. For more information pertaining to this plan, contact the Graduate Program Option Coordinator of the home department.

### *SELF-DIRECTED PLAN*

Although a series of technical concentration areas has been suggested, a student may wish to develop his/her own plan of study. A series of courses may be selected to meet a specific professional goal/objective. The student must meet with an advisor to develop a self-directed curriculum plan. A total of 33 s.h. of course work is required for a non-thesis, and 30 s.h. for a thesis plan. Students pursuing the non-thesis plan must complete a 3 s.h. special project course. For more information pertaining to this option, refer to the home department's graduate program description or contact the home department Graduate Program Option Coordinator.

### *EARLY PLACEMENT PROGRAM FOR THE PH.D. IN ENGINEERING*

Early placement programs for the Ph.D. degree in Engineering at the University of Akron and the Doctorate degree in Engineering at the Cleveland State University are also available. Students accepted in either program are required to complete a minimum of 60 s.h. beyond the M.S. degree. Students enrolled in either program can complete up to 12 s.h. of course work and 12 s.h. of dissertation work at Youngstown State University. In addition, students may select their coadvisor from the engineering faculty at Youngstown State University. Students interested in any of these options should select the thesis plan for their MS program. For further assistance regarding these options and to initiate a letter of interest, contact the College of Engineering and Technology Graduate Program option coordinator in the student's area of interest.

## **MECHANICAL ENGINEERING**

OPTION COORDINATOR: H.W. Shawn Kim  
2545 Moser Hall  
(330) 941.1731  
hwkim@ysu.edu

### **OPTION DESCRIPTION**

The Program option in Mechanical Engineering offers the Master of Science in Engineering degree with specialization within the general mechanical engineering disciplines. Thesis, nonthesis, or management plans are available. The department also offers students an area of concentration for interdisciplinary graduate studies with specialization in Solid/Structural Mechanics, Control Systems, and Energy/Power Systems. A student may also develop a self-directed/career-oriented program of study.

The technical concentration plan is for students who seek to deepen their theoretical knowledge and strengthen their ability to solve more advanced engineering problems, while the management plan is for those who wish to include managerial training in their program of preparation. The three specialized areas of interdisciplinary studies allow students to focus on specialized areas that require interdisciplinary cooperation among the Departments of Civil Engineering, Electrical Engineering, and Chemical Engineering.

The Department of Mechanical Engineering has excellent computer and laboratory facilities that provide for the following design and research capabilities: solid modeling; FEA in stress analysis; structural dynamics, and heat transfer; experimental stress analysis; vibrations and noise control; computational and experimental heat transfer and fluid dynamics; and advanced machine design.

### **FACULTY RESEARCH INTERESTS**

Hyun W. Kim, Ph.D., P.E., Professor  
Heat transfer; alternative energy; fluid power

Ganesh Kudav, Ph.D., P.E., Professor  
Fluid dynamics; energy conversion and analysis; hydraulics

Hazel M. Marie, M.S., Instructors  
Control; fluid thermal sciences; CAD; modeling

Robert A. McCoy, D.Eng., Professor  
Failure analysis of materials

Elvin B. Shields, Ph.D., P.E., Associate Professor  
Flow-induced vibration; advanced fracture mechanics

Daniel H. Suchora, Ph.D., P.E., Professor and Chair  
Kinematics and dynamics of machines; finite element analysis

### **DEGREE REQUIREMENTS**

The Department of Mechanical and Industrial Engineering provides opportunities for postbaccalaureate study toward the Master of Science in Engineering. Students exercising the thesis option are required to complete 24 semester hours of course work, and at least six semester hours of thesis. Students choosing the nonthesis option will be required to complete 30 semester hours of course work and complete MECH 6992-Graduate Project. A topic for the graduate project may be selected that is mutually of interest to the student, faculty of engineering school, and/or engineering industry. The course work must include nine semester hours of engineering core courses for the thesis option or 12 semester hours for non-thesis option. The basic degree requirements are described under the general program description for the Master of Science in Engineering. However, for the technical concentration with management emphasis 12 semester hours of core courses, 12 semester hours of mechanical engineering courses, nine semester hours of business courses, and three semester hours of special topics are required. The student, at the time of initial enrollment, will be assigned an academic advisor and, with the help of his/her 139 advisor, shall develop a study plan that includes goals and desired outcomes, and course work plan. The plan may be revised, if necessary, as the study progresses.

## MECHANICAL ENGINEERING

Daniel H. Suchora, Chair of the Department  
2515 Moser Hall  
(330) 941.3015

5811.\* *Solar Engineering* (3 s.h.)

5825.\* *Heat Transfer II* (3 s.h.)

5836. *Fluid Power and Control* (3 s.h.)

5852. *Stress and Strain Analysis II* (3 s.h.)

5872.\* *Engineering Acoustics* (3 s.h.)

5884.\* *Finite Element Analysis* (3 s.h.)

5892.\* *Control of Mechanical Systems* (3 s.h.)

6900. *Special Topics*. Special topics and new developments in mechanical engineering. Subject matter and credit hours to be announced in advance of each offering. Prereq.: As announced, or permission of instructor. May be taken three times. 2-4 s.h.

6904. *Advanced Thermodynamics*. Laws of equilibrium thermodynamics; relations between properties and aspects of the Second-Law. Energy analysis. Macroscopic and microscopic considerations for the prediction of properties. Microscopic description based on classical and quantum statistics. General stability criteria, statistical equilibrium, and trend toward equilibrium fluctuations. Prereq.: Senior standing or consent of graduate advisor. 3 s.h.

6915.\* *Failure Analysis*. Advanced methods in failure analysis of metallics, ceramics, polymers, and composites. Numerous practical examples will be discussed. Individual student projects using SEM are required. Three hours lecture and three hours laboratory. 3 s.h.

6925.\* *Computational Heat Transfer*. Numerical modeling techniques and methods in heat transfer. Computational analysis of conduction and convection by the finite element method, finite difference method, and the method of coordinate transformation. Prereq.: MECH 3725 and MATH 3705, or consent of instructor. 3 s.h.

6930.\* *Advanced Fluid Mechanics and Heat Transfer*. Viscous and inviscid flows: Navier Stokes equations, Euler equations, and complex variables methods. Analytic solutions to advanced heat transfer problems; advanced boundary-value problems. Prereq.: MECH 3725 or equivalent. 3 s.h.

6945.\* *Advanced Dynamics*. Three-dimensional vector statics; kinematics and kinetics of particles and rigid bodies; energy, momentum, and stability. LaGrange's equations of motion for particles and rigid bodies impulse; small oscillations; non-holonomic and dissipative systems. Prereq.: Consent of graduate advisor. 3 s.h.

6952.\* *Applied Elasticity*. Equations of equilibrium, compatibility and boundary conditions; their applications to plane-stress and plane-strain problems. Stress functions, strain energy methods, stress distribution in anile symmetrical bodies; special problems in structures involving torsion and bending of prismatical bars. Prereq.: MECH 3751 or equivalent or consent of graduate advisor. 3 s.h.

6962.\* *Mechanical Design Analysis*. The study of analytical aspects and the application of engineering science topics to machine elements and machinery. Some case studies in mechanical design. Prereq.: Consent of graduate advisor. 3 s.h.

6963.\* *Advanced Stress Analysis*. Theory and engineering applications of the most recent techniques of experimental stress analysis; brittle coatings, photoelasticity, strain gauges, photostress. Prereq.: MECH 3751 or equivalent or consent of graduate advisor. 3 s.h.

6983. *Modern Power Sources*. Analytical and descriptive study of modern power plants. Combustion and environmental problems with fossil fueled power plants. Electromagnetic circuits and devices with emphasis on the principles of electromechanical energy conversions. Cross-listed as CHEGR 6983 and ELEGR 6983. Prereq.: Consent of graduate advisor. 3 s.h.

6985. *Electromechanical Motion Devices*. Thermodynamics of batteries, and electric and fuel cells. Power from nuclear isotopes. Features common to rotating electromagnetic fields. Analysis and design of electromechanical power components. Logical circuit design with I/O structure and interface. Cross-listed as CHEGR 6985 and ELEGR 6985. 3 s.h.

6990. Thesis. 2.6 s.h.

6991. Thesis. 2.6 s.h.

6992. *Graduate Projects*. Analysis, design, research, or other independent investigation on projects selected with the advice and approval of the student's graduate committee. 3 s.h.

\* additional fee required