MECHANICAL ENGINEERING DEPARTMENT'S

MASTER OF SCIENCE DEGREE

- REQUIREMENTS AND PROCEDURES -

This Guidebook supplements information contained in the Graduate Bulletin, available in the Graduate School website.

MECHANICAL ENGINEERING DEPARTMENT
MASTER OF SCIENCE DEGREE
REQUIREMENTS AND PROCEDURES

General Admission Requirements

Applicants must hold a bachelor's degree from a program that is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) at the time of graduation, or provide evidence of an equivalent academic background to the department.

Applicants must submit official undergraduate transcripts, undergraduate grade point average, three letters of recommendation, and a statement of purpose. Personal statements or descriptions of post-baccalaureate experience that provide a rationale for proposed graduate study may also be submitted.

Official results of the analytical writing and quantitative portions of the GRE must be submitted. The GRE minimum requirements for admission into graduate programs in the College of Engineering can be met by one of the four score combinations below:

Analytical Writing	Quantitative Current Scale	Quantitative Prior Scale
3.0	159	750
3.5	153	680
4.0	149	620
4.5	146	550

The GRE requirement may be waived for students holding degrees from ABET accredited programs (with department approval).

Applicants with a bachelor's degree must have an overall grade-point average of 2.75 or better or 3.00 for the last two years (64 semester credits or equivalent).

Applicants whose native language is not English must have a minimum score of 213 on the computer-based TOEFL or 79 on the internet-based TOEFL, or a minimum score of 6.5 on the International English Language Testing System (IELTS).

Applicants who do not satisfy the requirements for Full Admission may be granted Provisional Admission or Deferred Admission.

Departmental Admission Requirements

Applicants with a bachelor's degree in a discipline other than engineering shall have completed coursework in calculus, differential equations, have one year of classical physics, and must select and complete undergraduate coursework from the list below ("Bridge-up Coursework") according to their background and interests. These undergraduate engineering courses may be taken prior to graduate admission or concurrently if the student has *full admission* or *provisional admission* and is enrolled for at least 9 graduate credits.

Bridge-up Coursework

Course #	Title	Credits
4600:300	Thermodynamics I	3
4600:301	Thermodynamics II	2
4600:311	Fluid Mechanics II	2
4600:315	Heat Transfer	3
4600:336	Analysis of Mechanical Components	3
4600:340	System Dynamics & Response	3
4600:380	Mechanical Metallurgy	2
4600:431	Fundamental of Mechanical Vibrations	3
4600:441	Control System Design	3

General Degree Requirements

The University's Academic Requirements (See **Academic Requirements** in the University *Graduate Bulletin*), the following College of Engineering requirements and the department's academic requirements must all be satisfied for the Master of Science degree in the College of Engineering.

- Identify the Advisory Committee before completion of 9 credit hours of coursework. The Advisory Committee consists of a major advisor and a Co-Advisor. The major advisor must be a faculty member of the Mechanical Engineering Department.
- Complete a formal Plan of Study that is acceptable to the Advisory Committee with a minimum of 24 credit hours of coursework of which no more than 6 credits are special topics courses. The formal Plan of Study may be revised upon approval of the Advisory Committee.
- Successfully (no "fail" votes) defend the thesis before the Advisory Committee, or have the Engineering Report approved by the Advisory Committee, or successfully complete the appropriate department's non-thesis option requirements.

Departmental Degree Requirements

Master's students in mechanical engineering must complete 30 credits if they select the thesis option and 32 credits if they take the non-thesis option, as detailed in the following:

Thesis Option		**Non-Thesis Option**	
Mechanical Engineering Courses	15	Mechanical Engineering Courses	15
Approved Mathematics	3	Approved Mathematics	3
Approved Electives	6	Approved Electives	12
Master's Thesis	6	Engineering Report	2
Total	**30**	Total	**32**

Notes:

1. At least two of the mechanical engineering courses must be designated as core courses (see "Core Courses" below)
2. Students are limited to not more than three 500-level courses in engineering. Not more than two of the 500-level courses can be applied to the 15 credits of mechanical engineering coursework. Students taking 500 level courses with dual number (undergraduate and graduate) can only receive credit towards the graduate degree if the similar course was not taken for undergraduate credit.
3. No Computer Physics, Fortran, C Programming, etc. are permitted for graduate credits.
4. Engineering Analysis (4600:660) may replace approved mathematics.
5. Courses in Statistics (3470:***) may also satisfy approved mathematics upon the approval of the student's advisor.
6. Students following the non-thesis option do not register for Master's Thesis (4600:699). They do, however, enroll in Engineering Report (4600:697), but only once, and usually at the culmination of their graduate study.
7. All master's degree requirements must be completed within six years.
8. Students receiving assistantship must take the thesis option and they have a maximum of two years to complete their degree requirements.

Core Courses

All MS students are required to take at least 2 of the following Mechanical Engineering core courses:

4600:609 – Finite Element Analysis I
4600:610 – Dynamics of Viscous Flow
4600:611 - Computational Fluid Dynamics I
4600:615 – Conduction Heat Transfer
4600:622 – Continuum Mechanics
4600:628 – Mechanical Behavior of Materials
4600:630 – Vibrations of Discrete Systems
4600:660 - Engineering Analysis (will not count towards the 2 required core courses if it is used to substitute the math requirement)
4600:666 – Analysis of Manufacturing Systems

PROCEDURE FOR ADVISING M.S. STUDENTS

The main reason for this procedure is to serve the graduate student by utilizing the faculty resources and expertise and student talents in a most efficient and mutually beneficial manner. The graduate students and the faculty are expected to observe the following guidelines as close as possible. In special circumstances the Department Chair may be referred to for clarification.

1. New M.S. students will initially be advised by the Department Chair or a faculty member designated by the Department Chair.

2. After the visit with the Department Chair and within the time frame of the first semester of graduate work the student should visit with the faculty doing work in the student's area of interest. Such visits should be explored with as many faculty members as possible.

3. The student should feel free to repeat such visits as necessary until a clear desire of mutual working relationships between faculty and student is established. After that, the student should select an Advisor for the M.S. thesis or for the Special Topics project. The selection of the advisor can take place anytime after the first visit but no later than the accumulation of 9 credits of coursework.

4. A second faculty member will be selected as the student's Co-Advisor by the mutual consent of the student and the Advisor.

5. The selection of Advisor and Co-Advisor must be approved by the Department Chair and must be recorded with the department. The student and the Advisor will work out a formal Plan of Study (without exception). The Plan of Study must be signed by the Co-Advisor and the Department Head and a copy kept in the student's file.

6. Revisions to the Plan of Study may be made at the request of the student and requires the same signing procedure as the original Plan of Study. The approval of minor revisions and course substitutions are left to the discretion of the Advisor.

7. At any time, the student may request the Department Chair, in writing (stating the justification), for a change in Advisor and/or Co-Advisor. Any change in advisorship must be authorized by the Department Chair.

8. The 2-credit project for non-thesis option will result in a typewritten report which will be:

    a) Neatly and thoroughly drafted.

    b) Read and signed by the Advisor and Co-Advisor and approved by the Department Chair on the Project Cover sheet.

    c) Filed with the Department in the student's file.

MSME Plan of Study

Objective/Specialty:_____

Name:_____ Date:_____

Advisor:_____ Co-Advisor:_____

GRADUATE COURSES

Design & Robotics

4600:544 Robot Design, Control & Application (3)
4600:562 Pressure Vessel Design (3)
4600:563 CAD/CAM (3)
4600:631 Kinematic Design (3)
4600:632 Reliability in Design (3)

Dynamics, Vibrations, and Acoustics

4600:530 Machine Dynamics (3)
4600:532 Vehicle Dynamics (3)
4600:629 Non-Linear Engineering Problems (3)
4600:630 Vibrations of Discrete Systems (3)
4600:633 Computerized Modal Analysis of Structures (3)
4600:634 Advanced Dynamics of Rotating Machinery (3)
4600:635 Stress Waves in Solids and Fluids (3)
4600:730 Vibrations of Continuous Systems (3)
4600:731 Random Vibrations (3)
4600:732 Advanced Modal Analysis of Structures (3)

Mechanics and Materials

4300:551 Matrix Analysis of Structures (3)
4300:681 Advanced Engineering Materials (3)
4300:682 Elasticity (3)
4300:702 Plates and Shells (3)
4300:703 Applications in Plasticity and Viscoelasticity (3)
4600:522 Experimental Stress Analysis I (3)
4600:609 Finite Element Analysis I (3)
4600:620 Experimental Stress Analysis II (3)
4600:621 Introduction to Tire Mechanics (3)
4600:622 Continuum Mechanics (3)

Solid Mechanics (cont'd)

4600:623 Applied Stress Analysis I (3)
4600:624 Fundamentals of Fracture Mechanics (3)
4600:625 Analysis of Mechanical Components (3)
4600:626 Fatigue of Engineering Materials (3)
4600:627 Advanced Materials and Manufacturing Processes (3)
4600:628 Mechanical Behavior of Materials (3)
4600:629 Nonlinear Engineering Problems (3)
4600:704 Finite Element Analysis II (3)
4600:723 Applied Stress Analysis II (3)
4600:726 Non-Linear Continuum Mechanics (3)

Compressible and Incompressible Fluid Mechanics

4200:716 Non-Newtonian Fluid Mechanics (3)
4300:640 Advanced Fluid Mechanics (3)
4600:500 Thermal System Components (3)
4600:511 Compressible Fluid Mechanics (3)
4600:512 Fundamentals of Flight (3)
4600:513 Introduction to Aerodynamics (3)
4600:514 Introduction to Aerospace Propulsion (3)
4600:550 Introduction to Computational Fluid Flow and Convection (3)
4600:600 Gas Dynamics (3)
4600:610 Dynamics of Viscous Flow I (3)
4600:611 Computational Fluid Dynamics I (3)
4600:650 Tribology (3)
4600:710 Dynamics of Viscous Flow II (3)
4600:711 Computational Fluid Dynamics II
4600:715 Hydrodynamics Stability (3)

Heat Transfer and Energy Systems

4200:600 Transport Phenomena (3)
4200:701 Advanced Transport Phenomena (2)
4200:721 Topics in Energy Transport (2)
4600:510 Heating and Air Conditioning (3)
4600:515 Energy Conversion (3)
4600:516 Heat Transfer Processes (3)
4600:608 Thermodynamics (3)
4600:615 Conduction Heat Transfer (3)
4600:616 Convection Heat Transfer (3)
4600:617 Radiation Heat Transfer (3)
4600:618 Boiling Heat Transfer and Two-Phase Flow (3)
4600:693 Measurements Methods and Experimental Error in Thermofluid Sciences
4600:719 Advanced Heat Transfer

Systems and Controls

4400:676 Random Process Analysis (3)
4400:776 Optimal Control I (3)
4400:777 Optimal Control II (3)
4400:778 Adaptive Control (3)
4600:541 Control Systems Design (3)
4600:542 Industrial Automatic Control (3)
4600:543 Optimization Methods in Mech. Engrg. (3)
4600:642 System Analysis and Control Design (3)
4600:643 Distributed Process Control Design & Appli. (3)
4600:645 Process Identification/Computer Control (3)
4600:646 Expert Systems in Control Manufacturing (3)
4600:647 Neural and Fuzzy Control Systems (3)
4600:670 Integrated Flexible Cellular Mfg. Sys. (3) _____
4600:741 Optimization Theory and Appl. (3)

Engineering Analysis

4600:660 Engineering Analysis (3)
4600:763 Advanced Methods in Engineering Analysis (3)

Special Topics, Thesis and Seminar

4600:697 Special Topics (Engineering Report)
4600:699 Master's Thesis (6)
4600:790 Advanced Seminar in Mechanical Engrg. (1-4)

Mathematics and Others

_____ _____
_____ _____
_____ _____
_____ _____

APPROVAL

Student: _____ Advisor:

Co-Advisor: _____ Dept. Chair:

cc: Student's File
Advisor
Co-Advisor
Dept. Chair

Schedule of Graduate Courses

Odd Year

Spring	Fall
515 Energy Conversion	510 Heating Ventilating and Air Conditioning Systems
530 Machine Dynamics	532 Vehicle Dynamics
531 Fundamentals of Mechanical Vibrations	550 Introduction to Computational Fluid Flow and Convection
541 Control Systems Design	562 Pressure Vessel Design
544 Robot Design Controls and Applications	
563 CAD/CAM	

Spring	Fall
600 Gas Dynamics	608 Thermodynamics
611 Computational Fluid Dynamics I	609 FEA I
615 Conduction Heat Transfer	610 Dynamics of Viscous Flow
623 Applied Stress Analysis I	617 Radiation Heat Transfer
628 Mechanical Behavior of Materials	622 Continuum Mechanics
629 Nonlinear Engineering Problems	624 Fundamentals of Fracture Mechanics
655 Micro- and Nano-Fluid Dynamics	630 Vibrations of Discrete Systems
660 Engineering Analysis	631 Kinematic Design
661 Failure Analysis of Mechanical Systems	633 Computational Modal Analysis of Structures
662 Microscale Heat and Mass Transfer	634 Advanced Dynamics of Rotary Machines
696 ST: Corrosion in Engineering	647 Neural/Fuzzy Control Systems
696 ST: Fundamentals of Composite Processing and Mechanics	650 Tribology
696 ST: Structural Analysis of Tires I*	666 Analysis of Manufacturing Systems
	670 Integrated Flexible Manufacturing
	671 Fundamentals and Applications of MEMS
	696 ST: Analysis of Manufacturing Systems
	696 ST: Robot Design Control and Applications II
	696 ST: Structural Analysis of Tires II*

Spring	Fall
704 FEA II	730 Vibrations of Continuous Systems
710 Dynamics of Viscous Flow II	
719 Advanced Heat Transfer	
763 Advanced Methods in Engineering Analysis	

*696 ST: Structural Analysis of Tires I, II are offered at Goodyear only

Even Year

Spring	Fall
516 Heat Transfer Processes	532 Vehicle Dynamics
522 Experimental Stress Analysis	543 Optimization Methods in Mechanical Engineering
531 Fundamentals of Mechanical Vibrations	
541 Control Systems Design	

Spring	Fall
600 Gas Dynamics	609 FEA I
611 Computational Fluid Dynamics I	610 Dynamics of Viscous Flow
615 Conduction Heat Transfer	616 Convection Heat Transfer
625 Analysis of Mechanical Components	618 Boiling Heat Transfer Two Phase Flows
627 Advanced Materials and Manufacturing Processes	622 Continuum Mechanics
628 Mechanical Behavior of Materials	626 Fatigue of Engineering Materials
635 Stress Waves in Solids and Fluids	630 Vibrations of Discrete Systems
646 Expert Systems in Controls and Manufacturing	632 Reliability in Design
660 Engineering Analysis	645 Process Identification Computer Control
664 Fundamentals of Crystallization and Solidification	658 Mechanical Behavior of Nanostructured Materials
672 Design of Micro- and Nano-scale Devices	663 Web-based Solid Modeling and E-manufacturing
693 Measurement Methods and Experimental Error	666 Analysis of Manufacturing Systems
694 Deformation and Failure of Polymers and Soft Materials	696 ST: Combustion
696 ST: Bio-heat and Mass Transfer	696 ST: Magnetohydrodynamics
696 ST: Industrial Experimentation	696 ST: Materials for Extreme Environments
696 ST: Introduction to Systems Engineering	696 ST: Six Sigma
696 ST: Multi-scale and Multi-physics Models	696 ST: Structural Analysis of Tires II*
696 ST: Structural Analysis of Tires I*	

Spring	Fall
726 Nonlinear Continuum Mechanics	711 Computational Fluid Dynamics II

*696 ST: Structural Analysis of Tires I, II are offered at Goodyear only