The Department offers the Master of Science degree in Mechanical or Aerospace Engineering without thesis. The quantitative requirement for the degree is 30-credit hours (normally 10 courses), completed with a grade-point average of 2.7 or better. Course programs may be composed from one area of specialization below (MSME) or in aerospace engineering (MSAE). They must conform to the following distribution:

- **Applied Mathematics**: 6 credits
- **Area of Specialization**: 15 credits
- **Electives**: 9 credits

Electives may be chosen in any area of engineering or mathematics at 400 level or higher. Of the 30 units, a minimum of 24 must be 500-level courses. No more than 6 units may be 400-level courses; core requirements for the BSME are not allowed (with the exception of MEMS 4301 Modeling, Systems and Control). A maximum of 3 credits of Independent Study, MEMS 400/500, may be used. A minimum of 15 units must be in MEMS. Non-engineering courses (e.g., T-courses, finance, etc.) do not count. Full-time MS students are required every semester to take MEMS 501 Seminar, which is a zero-unit, pass-fail course.

Degree candidates will plan their course programs with the help of a departmental advisor. Given below are partial listings of courses recommended for satisfaction of distribution requirements in mathematics and each of the available areas of specialization.

**APPLIED MATHEMATICS**

- ESE 405: Reliability and Quality Control
- ESE 415: Optimization
- ESE 501-502: Mathematics of Modern Engineering I, II
- ESE 517: Partial Differential Equations
- ESE 520: Probability and Stochastic Processes
- Math 416: Complex Variables
- Math 429-430: Linear Algebra, Modern Algebra
- Math 449: Numerical Applied Mathematics
- Math 4111: Intro to Analysis
- Physics 501-502: Theoretical Physics (must know quantum mechanics)
- Physics 503-504: Advanced Math Methods for Physicists and Engineers
- MEMS 5001: Optimization Methods in Engineering
- MEMS 5301: Nonlinear Vibrations
- MEMS 5403: Conduction and Convection Heat Transfer
- MEMS 5501: Mechanics of Continua
- MEMS 5610: Quantitative Materials Science and Engineering
AREAS OF SPECIALIZATION for MS in Mechanical Engineering (choose one area only)

**APPLIED MECHANICS**

MEMS 5301  Nonlinear Vibrations  
MEMS 5302  Theory of Vibrations  
MEMS 5401  Thermodynamics  
MEMS 5506  Experimental Methods in Solid Mechanics  
MEMS 5410-5411  Fluid Dynamics I and II (Fluids I is not required for Fluids II)  
MEMS 5414  Aeroelasticity and Flow-Induced Vibrations  
MEMS 5416  Turbulence  
MEMS 5500  Elasticity  
MEMS 5501  Mechanics of Continua  
MEMS 5507  Fatigue and Fracture Mechanics  
MEMS 5560  Interfaces and Attachments in Natural and Engineered Structures  
MEMS 5562  Cardiovascular Mechanics  
MEMS 5564  Orthopaedic Biomechanics-Cartilage/Tendon  
MEMS 5565  Mechanobiology of Cells and Matrices  
MEMS 5566  Engineering Mechanobiology  
MEMS 5601  Mechanical Behavior of Materials  
MEMS 5613  Biomaterials Processing  
MEMS 5515-5516  Numerical Simulation I, II  
BME 4xxx, 5xxx  All Biomechanics courses in BME

**DYNAMICS/MECHANICAL DESIGN**

ESE 441 or MEMS 4301  Control Systems (both cannot be counted at the same time for MS degree)  
ESE 446  Robotics  
ESE 447  Robotics Laboratory  
ESE 543  Control Systems Design by State-Space Methods  
ESE 547  Robust and Adaptive Control  
MEMS 424  Introduction to Finite Element Methods for Structural Analysis  
MEMS 463  Nanotechnology Concepts and Applications  
MEMS 4101  Manufacturing Processes  
MEMS 5001  Optimization  
MEMS 5102  Materials Selection  
MEMS 5104  CAE-Driven Mechanical Design  
MEMS 5301  Nonlinear Vibrations  
MEMS 5302  Theory of Vibrations  
MEMS 5414  Aeroelasticity and Flow-Induced Vibrations  
MEMS 5500  Elasticity  
MEMS 5501  Mechanics of Continua  
MEMS 5507  Fatigue and Fracture Mechanics  
MEMS 5515-5516  Numerical Simulation I, II  
MEMS 5601  Mechanical Behavior of Materials  
MEMS 5605  Mechanical Behavior of Composite Materials  
MEMS 5608  Introduction to Polymer Science and Engineering  
MEMS 5609  Electronic Material Processing  
MEMS 5611  Principles and Methods of Micro and Nanofabrication  
MEMS 5703  Analysis of Rotary-Wing Systems  
MEMS 5704  Aerospace Structures  
MEMS 5705  Wind Energy Systems
SOLID MECHANICS/MATERIALS SCIENCE

MEMS 424  Introduction to Finite Element Methods for Structural Analysis
MEMS 463  Nanotechnology Concepts and Applications
MEMS 5102 Materials Selections
MEMS 5500 Elasticity
MEMS 5501 Mechanics of Continua
MEMS 5502 Plates & Shells
MEMS 5506 Experimental Methods in Solid Mechanics
MEMS 5507 Fatigue and Fracture Mechanics
MEMS 5515-5516 Numerical Simulation in Solid Mechanics I, II
MEMS 5560 Interfaces and Attachments in Natural and Engineered Structures
MEMS 5601 Mechanical Behavior of Materials
MEMS 5602 Non-Metallics
MEMS 5603-5604 Materials Characterization I and II
MEMS 5605 Mechanical Behavior of Composite Materials
MEMS 5606 Soft Nanomaterials
MEMS 5607 Introduction to Polymer Blends and Composites
MEMS 5608 Introduction to Polymer Science and Engineering
MEMS 5609 Electronic Materials Processing
MEMS 5610 Quantitative Materials Science and Engineering
MEMS 5611 Principles and Methods of Micro and Nanofabrication
MEMS 5612 Atomistic Modeling of Materials
MEMS 5613 Biomaterials Processing
MEMS 5704 Aerospace Structures
MEMS 5801 Micro-Electrical Mechanical Systems
MEMS 5803 Topics in Nanotechnology

FLUID/THERMAL SCIENCES

EECE 572  Advanced Transport
MEMS 5401 Thermodynamics
MEMS 5402 Radiation Heat Transfer
MEMS 5403 Conduction and Convection Heat Transfer
MEMS 5404 Combustion Phenomenon
MEMS 5410-5411 Fluid Dynamics I and II (Fluids I is not required for Fluids II)
MEMS 5412-5413 Computational Fluid Dynamics I, II
MEMS 5414 Aeroelasticity and Flow-Induced Vibrations
MEMS 5416 Turbulence
MEMS 5420-5421 HVAC Analysis and Design I & II
MEMS 5422 Solar Energy Thermal Processes
MEMS 5424 Thermo-Fluid Modeling of Sustainable Energy Systems
MEMS 5425 Thermal Management of Electronics
MEMS 5426 Fundamentals of Solar Energy Thermal Processes
MEMS 5501 Mechanics of Continua
MEMS 5700 Aerodynamics
MEMS 5701 Aerospace Propulsion
MEMS 5703 Analysis of Rotary-Wing Systems
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