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:

\[
\begin{align*}
\text{Applied Mathematics} & : 6 \text{ credits} \\
\text{Area of Specialization} & : 15 \text{ credits} \\
\text{Electives} & : 9 \text{ credits}
\end{align*}
\]

Elective courses 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 in 500-level courses. No more than 6 units may be in 400-level courses; core requirements for the ME undergraduate degree are not allowed. A maximum of 3 credits of Independent Study, MEMS 400/500, may be included as an elective course. A minimum of 15 units must be in MEMS. Non-engineering courses (such as T-courses or finance and entrepreneurship) cannot be counted as engineering electives. Full-time MS students in any area are required to take MEMS 501 Seminar every semester, 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**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE 405</td>
<td>Reliability and Quality Control</td>
</tr>
<tr>
<td>ESE 415</td>
<td>Optimization</td>
</tr>
<tr>
<td>ESE 501-502</td>
<td>Mathematics of Modern Engineering I, II</td>
</tr>
<tr>
<td>ESE 517</td>
<td>Partial Differential Equations</td>
</tr>
<tr>
<td>ESE 520</td>
<td>Probability and Stochastic Processes</td>
</tr>
<tr>
<td>Math 416</td>
<td>Complex Variables</td>
</tr>
<tr>
<td>Math 429-430</td>
<td>Linear Algebra, Modern Algebra</td>
</tr>
<tr>
<td>Math 449</td>
<td>Numerical Applied Mathematics</td>
</tr>
<tr>
<td>Math 4111</td>
<td>Intro to Analysis</td>
</tr>
<tr>
<td>Physics 501-502</td>
<td>Theoretical Physics (must know quantum mechanics)</td>
</tr>
<tr>
<td>Physics 503-504</td>
<td>Advanced Math Methods for Physicists and Engineers</td>
</tr>
<tr>
<td>MEMS 5001</td>
<td>Optimization Methods in Engineering</td>
</tr>
<tr>
<td>MEMS 5301</td>
<td>Nonlinear Vibrations</td>
</tr>
<tr>
<td>MEMS 5403</td>
<td>Conduction and Convection Heat Transfer</td>
</tr>
<tr>
<td>MEMS 5501</td>
<td>Mechanics of Continua</td>
</tr>
<tr>
<td>MEMS 5610</td>
<td>Quantitative Materials Science and Engineering</td>
</tr>
</tbody>
</table>
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 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
MEMS 5706  Aircraft Performance
MEMS 5801  Micro-Electrical Mechanical 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 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
MEMS 5705  Wind Energy Systems
MEMS 5706  Aircraft Performance
MEMS 5801  Micro-Electrical Mechanical Systems