Specialization In: Control Systems and Mechatronics

The control systems specialization focuses on learning control system design techniques, theoretical analysis of the performance and robustness of feedback systems, state and parameter estimation techniques, and applications in robotics, automotive and fluid power systems.

**Fall Semester**

**Core Courses**
- ME 5281: Analog and Digital Control
- EE 5231: Linear Systems and Optimal Control

**Elective Courses**
- EE 5251/ AEM 5451: Optimal Filtering & Estimation
- AEM 5401: Intermediate Dynamics
- ME 8283: Design of Mechatronic Products (Odd Fall)
- ME 8284: Intermediate Robotics with Medical Appl’ns (Even Fall)
- ME 8287: Design and Control of Automotive Powertrains (Not offered in Fall 2019)
- AEM 8442: Navigation and Guidance Systems (Even Fall)

**Spring Semester**

**Core Courses**
- ME 8281: Advanced Control System Design (Odd Spring)
  OR
- ME 8285: Adv Control System Design, with Applications to Smart Vehicles (Even Spring)

**Elective Courses**
- ME 5248: Vibration Engineering (not offered in Spring 2020)
- ME 5286: Robotics
- EE 5235/ AEM 8421: Robust Multivariable Control Design
- CSCI 5552: Sensing and Estimation in Robotics
- EE 8215: Nonlinear Systems
- AEM 8423: Convex Optimizat’n Methods in Control (Occasional)
- AEM 8451: Syst Identification – Theory & Appl’ns (Occasional)
- ME 8287: Passivity and Control of Mech Systems (Occasional)

Note: 1. Some courses are not offered every year. 2. Please check for needed prerequisites. 3. We highly recommend that you seek advice from faculty advisors or potential faculty advisors.
**Specialization In: Design and Manufacturing**

In the D&M specialization, courses are offered in materials selection, manufacturing processes (including nano and micro fabrication), computer aided design and computational methods. Applications include medical devices, multifunctional materials, and fluid power.

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
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<tbody>
<tr>
<td><strong>Core Courses</strong></td>
<td><strong>Core Courses</strong></td>
</tr>
<tr>
<td>ME 5223 Materials in Design</td>
<td>ME 5241 Computer Aided Engineering</td>
</tr>
<tr>
<td>ME 5228 Finite Element Methods</td>
<td>ME 5243 Advanced Mechanisms</td>
</tr>
<tr>
<td><strong>Elective Courses</strong></td>
<td><strong>Elective Courses</strong></td>
</tr>
<tr>
<td>ME 8221 New Product Design I</td>
<td>ME 5221² Product Realization</td>
</tr>
<tr>
<td>ME 8254² MEMs</td>
<td>ME 5229/8229¹ Transient Finite Element Methods</td>
</tr>
<tr>
<td>ME 8255¹ Intro. Nanotech</td>
<td>ME 5247¹ Stress Analysis</td>
</tr>
<tr>
<td>AEM 4502¹ Comp. Structural Analysis</td>
<td>ME 5248 Vibration Engineering</td>
</tr>
<tr>
<td>ME 8283¹ Design of Mechatronic Products</td>
<td>ME 8228² Finite Element Methods: Flow/Thermal/Stress</td>
</tr>
<tr>
<td>AEM 5501 Continuum Mechanics</td>
<td>ME 8253² Comp Nanomechanics</td>
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<tr>
<td>EE 5171/73 Microelec Fab</td>
<td>AEM 4511 Composite Materials</td>
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<tr>
<td></td>
<td>AEM 5503 Theory of Elasticity</td>
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<tr>
<td></td>
<td>AEM 8531² Fracture Mechanics</td>
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<tr>
<td></td>
<td>BMEN 5151 Intro BioMEMS/Med devices</td>
</tr>
</tbody>
</table>

1: odd semester (i.e. F2017, S 2019)
2: even semester (i.e. F2018, S 2018)

Availability of courses outside of ME is based on 2018-2019 academic year catalog listing.
Specialization in: Fluid Mechanics

The Fluid Mechanics specialization focuses on the theory and applications of fluid flows pertinent to mechanical engineering. The courses cover the physical phenomena, mathematical formulations, problem-solving skills, measurement techniques, and numerical methods applicable to fluid flows ranging from microscale to turbulent flows encountered in mechanical engineering practice.

Fall Semester

Core Courses

• ME 5332 Intermediate Fluid Mechanics (preferred)
  OR
• AEM 8201 Fluid Mechanics I

Elective Courses

• ME 5344 Thermodynamics of Fluid Flow with Applications
• ME 8337 Experimental Methods in the Thermal Sciences
• ME 8390 Advanced Topics in the Thermal Sciences (when the topic is on fluid mechanics)
• AEM 5501 Continuum Mechanics
• AEM 8211 Theory of Turbulence I
• CHEN 8301 Physical Rate Processes I: Transport
• MATH 5587 Elementary Partial Differential Equations I OR MATH 8401 Mathematical Modeling and Methods of Applied Mathematics

Spring Semester

Core Courses

• ME 8332 Advanced Fluid Dynamics in Mechanical Engineering (preferred)
  OR
• AEM 8202 Fluid Mechanics II

Elective Courses

• ME 5351 Computational Heat Transfer
• ME 8342 Convection
• ME 8390 Advanced Topics in the Thermal Sciences (when the topic is on fluid mechanics)
• AEM 8207 Hydrodynamics Stability
• AEM 8212 Theory of Turbulence II
• CHEN 8102 Principles and Applications of Rheology
• MATH 5588 Elementary Partial Differential Equations II OR MATH 8402 Mathematical Modeling and Methods of Applied Mathematics

Note:
1. Some courses are not offered every year. Please check the class schedule and prerequisites.
2. It is highly recommended to seek advice from faculty advisors or potential faculty advisors.
Specialization In: Heat Transfer & Thermodynamics

Specialization in thermodynamic analysis of heat and mass transfer phenomena in industrial systems and in nature, for applications -including but not limited to- cooling/heating technologies, energy conversion systems, biomedical engineering, and biotechnology.

### Fall Semester

**Core Courses**
- ME 8341 Conduction

**Elective Courses**
- ME 5312 - Solar Thermal Technologies
- ME 5332 - Intermediate Fluid Mechanics
- ME 5344 – Thermo. Fluid Flow
- ME 5462 - Gas Turbines
- ME 5666 – Modern Thermo.
- ME 8337 - Experimental Methods Thermal Sciences
- ME 8361 -- Molecular Gas Dynamics
- ME 8390 - Advanced Topics Thermal Sciences
- AEM 5253 - Computational Fluids
- AEM 8201 - Fluids I
- BMEN 5321 – Microfluidics Bio/Med
- CHEN 8301 - Transport

### Spring Semester

**Core Courses**
- ME 8342 Convection

**Elective Courses**
- ME 5341 – Thermal Design/Case Studies
- ME 5461 - Internal Combustion Engines
- ME 5446 - Introduction to Combustion
- ME 8228 - Finite Elements in Flow/Thermal/Stress
- ME 8253 – Comput. Nanomechanics
- ME 8332 - Advanced Fluid Dynamics
- ME 8343 – Radiation
- ME 8350 - Heat Transfer Physics
- ME 8381 -- Bioheat Transfer
- ME 8446 - Advanced Combustion
- AEM 8253 – Comput. Fluid Mech
- BMEN 5311 -- Adv Biomed Transport

In the “Elective Courses” list above, Bold/gray courses are those offered by other departments in or close to HT&T areas. Some courses are offered every other yea. ME 5332 & ME 8332 are strongly encouraged.
Specialization In: Reactive and Particulate Flows

Reactive and particulate flows deals with fluid systems that involve chemical reactions or particles that are involved in many processes, including combustion, HVAC, plasmas, material synthesis and filtration.

**Fall Semester**

**Core Course**
- ME 8361 Molecular Gas Dynamics

**Specialized Core Course**
- ME 5113 Intro. Aerosols

**Elective Courses**
- ME 5133 Aerosol Laboratory
- ME 5332 Int. Fluid Mechs.
- ME 5344 Therm. Fluid Flow
- ME 5461 Combustion Engines
- ME 5462 Gas Turbines
- ME 5666 Modern Therm.
- ME 8341 Conduction
- ME 8345 Comp. Heat Trans.
- CHEN 5771 Colloids
- CHEN 8102 Rheology
- CHEN 8301 Phys Rate Proc I.
- AEM 5253 Comp Fluid Mechs
- AEM 8201 Fluid Mechanics I

**Spring Semester**

**Core Course**
- ME 8363 Intro. Reactive Flows

**Specialized Core Courses**
- ME 5446 Intro. Combustion
- ME 8362 Intro. Plasma Tech.
- ME 8446 Adv. Combustion

**Elective Courses**
- ME 5103 Thermal Environmental Engineering
- ME 8253 Computational Nanomechanics
- ME 8332 Advanced Fluids
- ME 8342 Convection
- AEM 8202 Fluid Mechanics II
- AEM 8232 Phys. Gas Dynamics
- CHEM 8021 Computational Chemistry

Note:
1. Some courses are not offered every year, and some courses may switch which semester they are offered. Please check the current class offering schedule and required prerequisites.
2. It is highly recommended to seek advice from faculty advisors or potential faculty advisors.
**General Mechanical Engineering**

MSME students interested in a well-rounded degree in mechanical engineering are encouraged to following guidelines noted below. Students following this schedule are expected to graduate in three semesters if completing the degree as full-time student (two Fall semesters and one Spring Semester). Students submitting degree plans composed of 30 credits chosen exactly from this list will satisfy MSME Plan C requirements and have their degree plans automatically approved. Others will need to provide written justification for when submitting their degree plan.

### Fall Semester

**Core Courses**
- ME 5281: Analog and Digital Controls
- ME 5332: Intermediate Fluid Mechanics
- AEM 5510: Continuum Mechanics

**Two of the following:**
- ME 5223: Materials in Design
- ME 5228: Finite Element Methods
- ME 5344: Thermodynamics of Fluid Flow With Applications
- ME 5666: Modern Thermodynamics
- ME 8341: Conduction
- EE 5231: Linear Systems and Optimal Control
- AEM 5401: Intermediate Dynamics
- BMEN 5001: Advanced Biomaterials
- BMEN 5201: Advanced Biomechanics

### Spring Semester

**Core Courses**
- ME 5241: Computer Aided Engineering

**Two of the following:**
- ME 5221: Product Realization
- ME 5243: Advanced Mechanism Design
- ME 5248: Vibration Engineering
- ME 5286: Robotics
- ME 5341: Case Studies in Thermal Design
- ME 5446: Introduction to Combustion
- ME 8332: Advanced Fluid Dynamics in Mechanical Engineering
- ME 8343: Radiation
- AEM 4511: Composite Materials