Graduate Course Structure for PhD and MS Students
Specialization areas and their corresponding courses

Note: if you want to use a course not on this list, get approval from your faculty advisor.

### Specialization: Fluid Mechanics
**Research Areas:** Fluid Mechanics

**Introductory courses**
- MAE 210A, B, C

**Advanced courses**
- MAE 212
- MAE 214A
- MAE 216
- MAE 215
- MAE 223
- MAE 224A, B

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### Specialization: Biomechanics
**Research Areas:** Biomechanics

**Introductory courses**
- MAE 209 / BENG 209

**Advanced courses**
- MAE 261
- MAE 262
- MAE 263
- MAE 266/MATS 252

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### Specialization: Combustion
**Research Areas:** Thermal Sciences, Engineering Physics

**Introductory courses**
- MAE 211
- MAE 212

**Advanced courses**
- MAE 213
- MAE 220A,B,C
- MAE 221A, B
- MAE 256

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### Specialization: Solid Mechanics
**Research Areas:** Materials Sciences, Applied and Solid Mechanics

**Introductory courses**
- MAE 231A,B

**Advanced courses**
- MAE 231C
- SE 273
MAE 233A, B  Fracture Mechanics; Micromechanics
MAE 235  Computational Techniques in Finite Elements
MAE 238  Stress Waves in Solids
MAE 267/MATS 253  Nanomaterials and Properties

Specialization: Environmental Engineering
Research Areas: Environmental Engineering
Introductory courses  MAE 210B  Fluid Mechanics II

Advanced courses  MAE 214A  Introduction to Turbulence and Turbulent Mixing
MAE 216  Ocean Turbulence and Mixing
MAE 221A, B  Heat Transfer; Mass Transfer;
MAE 224A, B  Environmental Fluid Dynamics
MAE 255  Boundry Layer/Renew Energy Meteorology
MAE 256  Radiative Transfer for Energy Applications
SIO 217A, B, C  Atmospheric and Climate Sciences I, II, III

Specialization: Applied Atmospheric Sciences
Research Area: Environmental Engineering

SIO 217A, B, C  Atmospheric and Climate Sciences I, II, III
SIO 218  Cloud Dynamics and Climate
SIO 236  Satellite Remote Sensing

Specialization: Design
Research Areas: Design
Introductory courses  MAE 291  Design and Mechanics in Computer technology
MAE 292  Computer-Aided Design and Analysis


Specialization: Linear and Optimal Control
Research Areas: Dynamics Systems and Control
Introductory courses  MAE 280A, B  Linear Systems Theory; Linear Control Design

Advanced courses  MAE 284  Robust and Multi-Variable Control
MAE 287  Control of Distributed Parameter Systems
MAE 288A  Optimal Control
MAE 288B  Optimal Estimation
MAE 289  Functional Analysis with Applications
MAE 290A, B  Efficient Numerical Methods for Simulation, Optimization and Control; Numerical Methods for Differential Equations

Specialization: Adaptive Systems and Dynamic Modeling
Research Areas: Dynamics Systems and Control
Introductory courses  MAE 242  Robot Motion Planning
MAE 247  Cooperative Control of Multi-Agent Systems
MAE 281A, B  Nonlinear Systems; Nonlinear Control

Advanced courses
MAE 282  Adaptive Control
MAE 283A  Parametric Identification, Theory & Methods
MAE 283B  Approximate Identification & Control
MAE 286  Hybrid Systems
MAE 222  Flow Control

Specialization: Materials Sciences
Research Areas: Materials Sciences, Applied and Solid Mechanics
Introductory courses
MATS 201A/MAE 271A  Thermodynamics of Solids
MATS 201B/MAE 271B  Solid State Diffusion & Reaction Kinetics

Advanced courses
MATS 201C/MAE 271C  Phase Transformations
MATS 205A/MAE 272  Imperfections in Solids
MATS 211/MAE 229A  Mechanical Properties
MATS 218/MAE 250  Fatigue, Fracture, and Failure
MATS 227/MAE 251  Structure and Bonding of Solids
MATS 213A,B  Dynamic Behavior of Materials I & II
MATS 233A,/MAE 252A,B  Processing & Synthesis of Advanced Materials
MATS 236/MAE 253  Ceramic & Glass Technology
MATS 251/MAE265  Structure & Properties of Electronic, Magnetic, Photonic Materials
MATS 252/MAE 266  Biomaterials and Medical Devices
MAE 253/MAE 267  Nanomaterials and Properties

Specialization: Applied Plasma Physics
Research Areas: Thermal Sciences, Engineering Physics
Introductory courses
MAE 217A  Introduction to Gas Discharge Plasma Physics
MAE 217B  Intro to Non-magnetized Plasma Physics
MAE 217C  Intro to Magnetized Plasma Physics
MAE 218A  Intro to High Energy Density Physics (MHD and Pinches)
MAE 218B  Intro to High Energy Density Physics (Laser-Plasma Interactions)

Advanced courses
MAE 227A  Fundamentals of Modern Plasma Physics (Magnetized Plasma)
MAE 227B  Fundamentals of Modern Plasma Physics (Laser-Plasma Interactions)
MAE 228  Selected Topics in Plasma Physics
PHYS 218A,B,C  Plasma Physics
PHYS 228  High Energy Astrophysics and Compact Objects
PHYS 235  Nonlinear Plasma Theory
ECE 240A  Laser and Optics

Specialization: Mathematics
Research Areas: Applied and Solid Mechanics, Material Sciences, Fluid Mechanics, Thermal Sciences, Engineering Physics, Dynamics Systems and Controls, Environmental Engineering, Biomechanics, Design
MAE 208  Mathematics for Engineers
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MAE 289</td>
<td>Functional Analysis and Applications</td>
</tr>
<tr>
<td>MAE 294A,B,C</td>
<td>Methods in Applied Mechanics I, II, III</td>
</tr>
<tr>
<td>MAE 290A,B</td>
<td>Efficient Numerical Methods for Simulation, Optimization and Control; Numerical Methods for Differential Equations</td>
</tr>
<tr>
<td>MATH 210A,B,C</td>
<td>Mathematical Methods in Physics and Engineering</td>
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<tr>
<td>MATH 211</td>
<td>Fourier Analysis on Finite Groups</td>
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<tr>
<td>MATH 212</td>
<td>Introduction to the Mathematics of Systems and Control</td>
</tr>
<tr>
<td>MATH 220A,B,C</td>
<td>Complex Analysis</td>
</tr>
<tr>
<td>MATH 221A,B,C</td>
<td>Topics in Several Complex Variables</td>
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<tr>
<td>MATH 227A,B,C</td>
<td>Topics in Complex Analysis</td>
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<tr>
<td>MATH 231A,B,C</td>
<td>Partial Differential Equations</td>
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<tr>
<td>MATH 233</td>
<td>Singular Perturbation Theory for Differential Equations</td>
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<tr>
<td>MATH 240A,B,C</td>
<td>Real Analysis</td>
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<tr>
<td>MATH 241A,B,C</td>
<td>Functional Analysis</td>
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<tr>
<td>MATH 247A</td>
<td>Topics in Real Analysis</td>
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<tr>
<td>MATH 250A,B,C</td>
<td>Differential Geometry</td>
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<tr>
<td>MATH 270A,B,C</td>
<td>Numerical Mathematics</td>
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<tr>
<td>MATH 271A,B,C</td>
<td>Numerical Optimization</td>
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<tr>
<td>MATH 272A,B,C</td>
<td>Numerical Partial Differential Equations</td>
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<tr>
<td>MATH 273A,B,C</td>
<td>Scientific Computation</td>
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<tr>
<td>MATH 274A</td>
<td>Topics in Real Analysis</td>
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<tr>
<td>MATH 280A,B,C</td>
<td>Probability Theory</td>
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<tr>
<td>MATH 285A,B</td>
<td>Stochastic Processes</td>
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<tr>
<td>MATH 286</td>
<td>Stochastic Differential Equations</td>
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<tr>
<td>MATH 287A,B,C</td>
<td>Time Series Analysis; Multivariate Analysis; Nonparametric Analysis</td>
</tr>
<tr>
<td>MATH 290A,B,C</td>
<td>Topology</td>
</tr>
</tbody>
</table>

**Specialization: Basic Science**

Research Areas: Applied and Solid Mechanics, Material Sciences, Fluid Mechanics, Thermal Sciences, Engineering Physics, Dynamics Systems and Controls, Environmental Engineering, Biomechanics, Design

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>CHEM 213</td>
<td>Chemistry of Macromolecules</td>
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<tr>
<td>CHEM 214</td>
<td>Molecular and Cellular Biochemistry</td>
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<tr>
<td>ECE 220</td>
<td>Space Plasma Physics</td>
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<td>ECE 222</td>
<td>Applied Electromagnetic Theory</td>
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<tr>
<td>ECE 253A</td>
<td>Digital Image Analysis</td>
</tr>
<tr>
<td>ECE 270A,B</td>
<td>Neurocomputing</td>
</tr>
<tr>
<td>PHYS 200A,B</td>
<td>Theoretical Mechanics</td>
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<tr>
<td>PHYS 201</td>
<td>Mathematical Physics</td>
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<tr>
<td>PHYS 203A,B</td>
<td>Advanced Classical Electrodynamics</td>
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<tr>
<td>PHYS 211A,B</td>
<td>Solid-State Physics</td>
</tr>
<tr>
<td>SIO 203A,B,C</td>
<td>Methods of Applied Analysis</td>
</tr>
</tbody>
</table>

Not all courses will be offered every year. Consult the course offerings for the current year.

If you want to use a course not on this list, get approval from your faculty advisor.

**A Note About MAE 207’s:**
MAE 207, Topics in Engineering Science, is often used to develop new courses before an actual course number is assigned. You may use 207’s as many as two times. The topics must be different from one another. If you want to use more, please consult with your faculty advisor or the MAE Graduate Advisor.

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