# Graduate Course Structure for PhD 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.

## Fluid Mechanics

**Introductory courses**
- MAE 210A, B, C  
  Fluid Mechanics I, II, III

**Advanced courses**
- MAE 212  
  Introductory Compressible Flow
- MAE 214A  
  Introduction to Turbulence and Turbulent Mixing
- MAE 214B  
  Ocean Turbulence and Mixing
- MAE 215  
  Hydrodynamic Stability
- MAE 222A, B, C  
  Advanced Fluid Mechanics
- MAE 223  
  Computational Fluid Dynamics
- MAE 224A, B  
  Environmental Fluid Dynamics

## Biomechanics

**Introductory courses**
- MAE 209 / BENG 209  
  Continuum Mechanics Applied to Medicine/Biology

**Advanced courses**
- MAE 250  
  Medical Device Materials
- MAE 261  
  Cardiovascular Fluid Mechanics
- MAE 262  
  Fluid Mechanics of the Cell
- MAE 263  
  Experimental Methods in Cell Mechanics
- MAE 266/MATS 252  
  Biomaterials and Medical Devices

## Combustion (Thermal sciences)

**Introductory courses**
- MAE 211  
  Introduction to Combustion
- MAE 212  
  Introductory Compressible Flow

**Advanced courses**
- MAE 213  
  Mechanics of Propulsion
- MAE 220A, B, C  
  Physics of Gases; Physical Gasdynamics; Nonequilibrium Gasdynamics

## Solid Mechanics

**Introductory courses**
- MAE 231A, B  
  Foundations of Solid Mechanics; Elasticity

**Advanced courses**
- MAE 231C  
  Anelasticity
  or
- SE 273  
  Theory of Plasticity and Viscoelasticity
- MAE 232A, B, C  
  Finite Element Methods in Solid Mechanics I, II, III
- MAE 233A, B, C  
  Fracture Mechanics; Micromechanics; Advanced Mechanics of Composite Materials
- MAE 235/SIO 233  
  Computational Techniques in Finite Elements
- MAE 238  
  Stress Waves in Solids
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<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tr>
<td>MAE 267/MATS 253</td>
<td>Nanomaterials and Properties</td>
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<td>MAE 270</td>
<td>Mechanics of Powder Processing</td>
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<td><strong>Environmental Engineering</strong></td>
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<td><strong>Introductory courses</strong></td>
<td><strong>MAE 210B</strong></td>
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<td><strong>Chemical Engineering</strong></td>
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<td><strong>Introductory courses</strong></td>
<td><strong>CENG 210A, MAE 210B</strong></td>
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<td><strong>Advanced courses</strong></td>
<td><strong>CENG 221A,B</strong></td>
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<td><strong>Design</strong></td>
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<td><strong>Introductory courses</strong></td>
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<td><strong>Advanced courses</strong></td>
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<td><strong>MAE 232A,B,C.</strong></td>
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<td><strong>Linear and Optimal Control</strong></td>
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<td><strong>Introductory courses</strong></td>
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<td><strong>Advanced courses</strong></td>
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<td><strong>MAE 287</strong></td>
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<td><strong>MAE 289</strong></td>
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<td><strong>MAE 290A, B</strong></td>
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<td><strong>Adaptive Systems and Dynamic Modeling</strong></td>
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<tr>
<td><strong>Introductory courses</strong></td>
<td><strong>MAE 242, MAE 247, MAE 281A, B</strong></td>
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<td><strong>Advanced courses</strong></td>
<td><strong>MAE 282</strong></td>
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<td><strong>MAE 283A</strong></td>
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MAE 283BApproximate Identification & Control
MAE 286Hybrid Systems
MAE **Optimization and Control of Fluid-Mechanical Systems

**Materials Sciences**

**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

**Applied Plasma 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

**Mathematics**

- MATH 210A,B,C Mathematical Methods in Physics and Engineering
- MATH 211 Fourier Analysis on Finite Groups
- MATH 212A Introduction to the Mathematics of Systems and Control
- MATH 220A,B,C Complex Analysis
- MATH 221A,B,C Topics in Several Complex Variables
- MATH 227A,B,C Topics In Complex Analysis
- MATH 231A,B,C Partial Differential Equations
- MATH 233 Singular Perturbation Theory for Differential Equations
MATH 240A,B,C  Real Analysis
MATH 241A,B,C  Functional Analysis
MATH 247A  Topics in Real Analysis

Mathematics (cont’d)

MATH 250A,B,C  Differential Geometry
MATH 270A,B,C  Numerical Mathematics
MATH 271A,B,C  Numerical Optimization
MATH 272A,B,C  Numerical Partial Differential Equations
MATH 273A,B,C  Scientific Computation
MATH 274A  Topics in Real Analysis
MATH 280A,B,C  Probability Theory
MATH 285A, B  Stochastic Processes
MATH 286  Stochastic Differential Equations
MATH 287A,B,C  Time Series Analysis; Multivariate Analysis; Nonparametric Analysis
MATH 290A,B,C  Topology

Basic Science

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

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.