

## 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.

#### Fluid Mechanics

Introductory courses	<b>MAE 210A,B,C</b>	Fluid Mechanics I, II, III
Advanced courses	<b>MAE 212</b> <b>MAE 214A</b> <b>MAE 216</b> <b>MAE 215</b> <b>MAE 223</b> <b>MAE 224A, B</b>	Introductory Compressible Flow Introduction to Turbulence and Turbulent Mixing Ocean Turbulence and Mixing Hydrodynamic Stability Computational Fluid Dynamics Environmental Fluid Dynamics

#### Biomechanics

Introductory courses	<b>MAE 209 /</b> <b>BENG 209</b>	Continuum Mechanics Applied to Medicine/Biology
Advanced courses	<b>MAE 261</b> <b>MAE 262</b> <b>MAE 263</b> <b>MAE 266/MATS 252</b>	Cardiovascular Fluid Mechanics Fluid Mechanics of the Cell Experimental Methods in Cell Mechanics Biomaterials and Medical Devices

#### Combustion (Thermal sciences)

Introductory courses	<b>MAE 211</b> <b>MAE 212</b>	Introduction to Combustion Introductory Compressible Flow
Advanced courses	<b>MAE 213</b> <b>MAE 220A,B,C</b>  <b>MAE 221AB</b> <b>MAE 256</b>	Mechanics of Propulsion Physics of Gases; Physical Gasdynamics; Nonequilibrium Gasdynamics Heat Transfer; Mass Transfer Radiative Transfer for Energy Applications

#### Solid Mechanics

Introductory courses	<b>MAE 231A,B</b>	Foundations of Solid Mechanics; Elasticity
Advanced courses	<b>MAE 231C</b> or <b>SE 273</b>  <b>MAE 232A,B,C</b> <b>MAE 233A,B</b> <b>MAE 235</b> <b>MAE 238</b>	Anelasticity  Theory of Plasticity and Viscoelasticity  Finite Element Methods in Solid Mechanics I, II, III Fracture Mechanics; Micromechanics Computational Techniques in Finite Elements Stress Waves in Solids

## MAE 267/MATS 253

## Nanomaterials and Properties

### Environmental Engineering

Introductory courses **MAE 210B**

Fluid Mechanics II

Advanced courses **MAE 214A**  
**MAE 216**  
**MAE 221A,B**  
**MAE 224A,B**  
**MAE 255**  
**MAE 256**

Introduction to Turbulence and Turbulent Mixing  
Ocean Turbulence and Mixing  
Heat Transfer; Mass Transfer;  
Environmental Fluid Dynamics  
Boundary Layer/Renew Energy Meteorology  
Radiative Transfer for Energy Applications

### Design

Introductory courses **MAE 291**  
**MAE 292**

Design and Mechanics in Computer technology  
Computer-Aided Design and Analysis

Advanced courses **MAE 232A,B,C**

Finite Element Methods in Solid Mechanics I, II, III

### Linear and Optimal Control

Introductory courses **MAE 280A, B**

Linear Systems Theory; Linear Control Design

Advanced courses **MAE 284**  
**MAE 287**  
**MAE 288A**  
**MAE 288B**  
**MAE 289**  
**MAE 290A, B**

Robust and Multi-Variable Control  
Control of Distributed Parameter Systems  
Optimal Control  
Optimal Estimation  
Functional Analysis with Applications  
Efficient Numerical Methods for Simulation, Optimization  
and Control; Numerical Methods for Differential Equations

### Adaptive Systems and Dynamic Modeling

Introductory courses **MAE 242**  
**MAE 247**  
**MAE 281A, B**

Robot Motion Planning  
Cooperative Control of Multi-Agent Systems  
Nonlinear Systems; Nonlinear Control

Advanced courses **MAE 282**  
**MAE 283A**  
**MAE 283B**  
**MAE 286**  
**MAE 222**

Adaptive Control  
Parametric Identification, Theory & Methods  
Approximate Identification & Control  
Hybrid Systems  
Flow Control

### Materials Sciences

Introductory courses **MATS 201A/MAE 271A**  
**MATS 201B/MAE 271B**

Thermodynamics of Solids  
Solid State Diffusion & Reaction Kinetics

Advanced courses **MATS 201C/MAE 271C**  
**MATS 205A/MAE 272**  
**MATS 211/MAE 229A**  
**MATS 218/MAE 250**  
**MATS 227/MAE 251**

Phase Transformations  
Imperfections in Solids  
Mechanical Properties  
Fatigue, Fracture, and Failure  
Structure and Bonding of Solids

<b>MATS 213A,B</b>	Dynamic Behavior of Materials I & II
<b>MATS 233A,/MAE 252A,B</b>	Processing & Synthesis of Advanced Materials
<b>MATS 236/MAE 253</b>	Ceramic & Glass Technology
<b>MATS 251/MAE265</b>	Structure & Properties of Electronic, Magnetic, Photonic Materials
<b>MATS 252/MAE 266</b>	Biomaterials and Medical Devices
<b>MAE 253/MAE 267</b>	Nanomaterials and Properties

### Applied Plasma Physics

Introductory courses	<b>MAE 217A</b>	Introduction to Gas Discharge Plasma Physics
	<b>MAE 217B</b>	Intro to Non-magnetized Plasma Physics
	<b>MAE 217C</b>	Intro to Magnetized Plasma Physics
	<b>MAE 218A</b>	Intro to High Energy Density Physics (MHD and Pinches)
	<b>MAE 218B</b>	Intro to High Energy Density Physics (Laser-Plasma Interactions)
Advanced courses	<b>MAE 227A</b>	Fundamentals of Modern Plasma Physics (Magnetized Plasma)
	<b>MAE 227B</b>	Fundamentals of Modern Plasma Physics (Laser-Plasma Interactions)
	<b>MAE 228</b>	Selected Topics in Plasma Physics
	<b>PHYS 218A,B,C</b>	Plasma Physics
	<b>PHYS 228</b>	High Energy Astrophysics and Compact Objects
	<b>PHYS 235</b>	Nonlinear Plasma Theory
	<b>ECE 240A</b>	Laser and Optics

### Mathematics

<b>MAE 289</b>	Functional Analysis and Applications
<b>MAE 294A,B,C</b>	Methods in Applied Mechanics I, II, III
<b>MAE 290A,B</b>	Efficient Numerical Methods for Simulation, Optimization and Control; Numerical Methods for Differential Equations
<b>MATH 210A,B,C</b>	Mathematical Methods in Physics and Engineering
<b>MATH 211</b>	Fourier Analysis on Finite Groups
<b>MATH 212A</b>	Introduction to the Mathematics of Systems and Control
<b>MATH 220A,B,C</b>	Complex Analysis
<b>MATH 221A,B,C</b>	Topics in Several Complex Variables
<b>MATH 227A,B,C</b>	Topics In Complex Analysis
<b>MATH 231A,B,C</b>	Partial Differential Equations
<b>MATH 233</b>	Singular Perturbation Theory for Differential Equations
<b>MATH 240A,B,C</b>	Real Analysis
<b>MATH 241A,B,C</b>	Functional Analysis
<b>MATH 247A</b>	Topics in Real Analysis
<b>MATH 250A,B,C</b>	Differential Geometry
<b>MATH 270A,B,C</b>	Numerical Mathematics
<b>MATH 271A,B,C</b>	Numerical Optimization
<b>MATH 272A,B,C</b>	Numerical Partial Differential Equations
<b>MATH 273A,B,C</b>	Scientific Computation
<b>MATH 274A</b>	Topics in Real Analysis
<b>MATH 280A,B,C</b>	Probability Theory
<b>MATH 285A, B</b>	Stochastic Processes
<b>MATH 286</b>	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.