## 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**  
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 216  
Ocean Turbulence and Mixing  
MAE 215  
Hydrodynamic Stability  
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 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  
MAE 221AB  
Heat Transfer; Mass Transfer  
MAE 256  
Radiative Transfer for Energy Applications

### 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  
Fracture Mechanics; Micromechanics  
MAE 235  
Computational Techniques in Finite Elements  
MAE 238  
Stress Waves in Solids
### Environmental Engineering

**Introductory courses**
- MAE 210B Fluid Mechanics II

**Advanced courses**
- MAE 214A Introduction to Turbulence and Turbulent Mixing
- MAE 215 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

### Design

**Introductory courses**
- MAE 291 Design and Mechanics in Computer technology
- MAE 292 Computer-Aided Design and Analysis

**Advanced courses**

### Linear and Optimal 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

### Adaptive Systems and Dynamic Modeling

**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

### 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

MAE 289  Functional Analysis and Applications
MAE 294A,B,C  Methods in Applied Mechanics I, II, III
MAE 290A,B  Efficient Numerical Methods for Simulation, Optimization and Control; Numerical Methods for Differential Equations
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
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.