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**	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

Specialization: Biomechanics
Research Areas: 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

Specialization: Combustion
Research Areas: Thermal Sciences, Engineering Physics, Energy

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; Nonequilibruim Gasdynamics
	MAE 221A, B	Heat Transfer; Mass Transfer
	MAE 256	Radiative Transfer for Energy Applications

Specialization: Solid Mechanics
Research Areas: Materials Sciences, Applied and 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 232ABC/SE 276ABC	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
MAE 267/MATS 253	Nanomaterials and Properties

Specialization: Environmental Engineering
Research Areas: Environmental Engineering, Energy

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 254/MATS 256	Energy Materials & Application
	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
Advanced courses	MAE 232ABC/SE 276ABC	Finite Element Methods in Solid Mechanics I, II, III

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
	MAE 254/MATS 256	Energy Materials & Application
	MATS 257	Polymer Science and Engineering

Specialization: Applied Plasma Physics
Research Areas: Thermal Sciences, Engineering Physics, Energy

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

MAE 208	Mathematics for Engineers
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

Specialization: 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.

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