E SC Technical Electives

A total of four Technical Elective (TE) courses are required.

Engineering Courses (select 2–4 courses)

Courses in **boldface type** can be used as *either* as a Technical Elective or as a Foundational Elective.

- AERSP 412 (Turbulent Flow)
- AERSP 424 (Advanced Computer Programming)
- AERSP 440 (Introduction to Software Engineering for Aerospace Engineers)
- AERSP 460 (Aerospace Control Systems)
- AERSP 473 (Composites Processing)
- AERSP 490 (Introduction to Plasmas)
- AERSP 492 (Space Astronomy and Introduction to Space Science)
- A E 421 (Architectural Structural Systems I)
- A E 424 (Environmental Control Systems I)
- A E 430 (Indeterminate Structures)
- A E 456 (Solar Energy Building System Design)
- A E 461 (Architectural Illumination Systems & Design)
- A E 464 (Advanced Architectural Illumination Systems & Design)
- A E 467 (Advanced Building Electrical System Design)
- A E 470 (Residential Building Design and Construction)
- BME 402 (Biomedical Instrumentation and Measurements)
- BME 406 (Medical Imaging)
- **BME 409** (Biofluid Mechanics)
- BME 410 (Biomedical Applications of Microfluidics)
- BME 413 (Mass Transport in Biological Systems)
- BME 419 (Artificial Organs and Prosthetic Devices)
- BME 423 (Reaction Kinetics of Biological Systems)
- BME 443 (Biomedical Materials)
- BME 444 (Surfaces and the Biological Response to Materials)
- BME 445 (Tissue Engineering: Concepts, Calculations and Applications)
- B E 461 (Design of Fluid Power Systems)
- B E 465 (Food and Biological Process Engineering)
- B E 467 (Design of Stormwater and Erosion Control Facilities)
- B E 468 (Microbiological Engineering)
- B E 477 (Land-Based Waste Disposal)
- B E 487 (Watershed Modeling for Water Quality Design)
- CH E 350 (Process Heat Transfer)
- CH E 432 (Petroleum Processing)
- CH E 438 (Bioprocess Engineering)
- CH E 442 (Polymer Processing Technology)
- C E 447 (Structural Analysis by Matrix Methods)
- C E 461 (Water-resource Engineering)
- C E 462 (Open Channel Hydraulics)
- C E 475 (Water Quality Chemistry)
- C E 479 (Environmental Microbiology for Engineers)
- CMPEN 416 (Digital Integrated Circuits)
- CMPEN 417 (Digital Design Using Field Programmable Devices)
- CMPEN 431 (Introduction to Computer Architecture)
- CMPEN 441 (Operating Systems)
- CMPEN 454 (Fundamentals of Computer Vision)
- CMPEN 455 (Digital Image Processing)
- CMPEN 461 (Communication Networks)
- CMPEN 471 (Logical Design of Digital Systems)
- CMPEN 472 (Microprocessors and Embedded Systems)
- CMPEN 475 (Functional Verification)
- CMPSC 402 (UNIX and C)
- CMPSC 421 (Net-centric Computing)
- CMPSC 426 (Object-oriented Design)
- CMPSC 428 (Programming in Ada)
- CMPSC 430 (Database Design)
- CMPSC 431W (Database Management Systems)
- CMPSC 436 (Communications and Networking)
- CMPSC 438 (Computer Network Architecture and Programming)
- CMPSC 441 (Artificial Intelligence)
- CMPSC 442 (Artificial Intelligence)
- CMPSC 448 (Machine Learning and Algorithmic AI)
- CMPSC 450 (Concurrent Scientific Programming)
- CMPSC 456 (Introduction to Numerical Analysis II)
- CMPSC 457 (Computer Graphics Algorithms)
- CMPSC 458 (Fundamentals of Computer Graphics)
- CMPSC 459 (Scientific Visualization)
- CMPSC 461 (Programming Language Concepts)
- CMPSC 462 (Data Structures)
- CMPSC 463 (Design and Analysis of Algorithms)
- CMPSC 464 (Introduction to the Theory of Computation)
- CMPSC 465 (Data Structures and Algorithms)
- CMPSC 467 (Factorization and Primality Testing)
- CMPSC 469 (Formal Languages with Applications)
- CMPSC 471 (Introduction to Compiler Construction)
- CMPSC 473 (Operating Systems Design & Construction)
- CMPSC 474 (Operating System & Systems Programming)

- CMPSC 479 (Language Translation)
- E E 413 (Power Electronics)
- E E 416 (Digital Integrated Circuits)
- E E 417 (Digital Design Using Field Programmable Devices)
- E E 420 (Electro-optics: Principles and Devices)
- E E 422 (Optical Engineering Laboratory)
- E E 424 (Principles and Applications of Lasers)
- E E 430 (Principles of Electromagnetic Fields)
- E E 432 (RF and Microwave Engineering)
- E E 438 (Antenna Engineering)
- E E 439 (Radiowave Propagation in Communications)
- E E 441 (Semiconductor Integrated Circuit Technology)
- E E 442 (Solid State Devices)
- E E 450 (Signal and Image Processing)
- E E 453 (Fundamentals of Digital Signal Processing)
- E E 454 (Fundamentals of Computer Vision)
- E E 455 (An Introduction to Digital Image Processing)
- E E 456 (Introduction to Neural Networks)
- E E 458 (Digital Image Processing and Computer Vision)
- E E 460 (Communication Systems II)
- E E 461 (Communications I)
- E E 471 (Introduction to Plasmas)
- E E 472 (Space Astronomy and Introduction to Space Science)
- E E 474 (Satellite Communications Systems)
- E E 477 (Fundamentals of Remote Sensing Systems)
- E E 481 (Control Systems)
- E E 483 (Introduction to Automation and Robotics Systems)
- E E 484 (Control System Design)
- EGEE 411 (Energy Science and Engineering Lab)
- EGEE 412 (Green Engineering & Environmental Compliance)
- EGEE 420 (Hydrogen and Fuel Cells)
- EGEE 430 (Introduction to Combustion)
- EGEE 433 (Physical Processes in Energy Engineering)
- EGEE 436 (Modern Thermodynamics for Energy Systems)
- EGEE 437 (Design of Solar Energy Conversion Systems)
- EGEE 438 (Wind and Hydropower Energy Conversion)
- EGEE 441 (Electrochemical Engineering Fundamentals)
- EGEE 451 (Energy Conversion Processes)
- EGEE 455 (Materials for Energy Applications)
- EGEE 456 (Introduction to Neural Networks)
- EGEE 470 (Air Pollutants from Combustion Sources)
- EME 407 (Electrochemical Energy Storage)
- ENGR 421 (Materials Properties Measurements II)
- ENGR 450 (Materials Design and Applications)
- EDSGN 401 (Engineering Systems Design)
- EDSGN 452 (Projects in Humanitarian Engineering)
- EDSGN 479 (Human Centered Product Design and Innovation)
- E MCH 400 (Advanced Strength of Materials and Design)
- E MCH 402 (Applied and Experimental Stress Analysis)
- E MCH 403 (Strength Design in Materials and Structures)
- E MCH 409 (Advanced Mechanics)
- **E MCH 416H** (Failure and Failure Analysis of Solids)
- E MCH 440 (Nondestructive Evaluation of Flaws)
- E MCH 446 (Mechanics of Viscoelastic Materials)
- E MCH 461 (Finite Elements in Engineering)
- E MCH 470 (Analysis and Design in Vibration Engineering)
- E MCH 471 (Engineering Composite Materials)
- E MCH 473 (Composites Processing)
- **E SC 400H** (Electromagnetic Fields)
- E SC 417 (Electrical and Magnetic Properties)
- **E SC 419** (Electronic Properties and Applications of Materials)
- E SC 445 (Semiconductor Optoelectronic Devices)
- E SC 450 (Synthesis and Processing of Electronic and Photonic Materials)
- E SC 455 (Electrochemical Methods Engineering and Corrosion Science)
- E SC 456 (Introduction to Neural Networks)
- E SC 475 (Particulate Materials Processing)
- E SC 481 (Elements of Nano/Micro-electromechanical Systems Processing and Design)
- E SC 482 (Micro-Optoelectromechanical Systems (MOEMS) and Nanophotonics)
- E SC 483 (Simulation and Design of Nanostructures)
- E SC 484 (Biologically Inspired Nanomaterials)
- ENVE 417 (Hydraulic Design)
- ENVE 424 (Solid Waste Management)
- ENVE 470 (Air Quality)
- ENVSE 404W (Surface and Interfacial Phenomena in Environmental Systems)
- ENVSE 440 (Industrial Ventilation for Contaminant Control)
- ENVSE 470 (Systems Safety and Risk Engineering)
- I E 405 (Deterministic Models in Operations Research)
- I E 408 (Cognitive Work Design)
- I E 418 (Human/Computer Interface Design)
- I E 419 (Work Design - Productivity and Safety)
- I E 424 (Process Quality Engineering)
- I E 425 (Stochastic Models in Operations Research)
- I E 428 (Metal Casting)
- I E 433 (Regression Analysis and Design of Experiments)
- I E 434 (Statistical Quality Control)

- I E 436 (Six Sigma Methodology)
- I E 454 (Applied Decision Analysis)
- I E 456 (Industrial Robot Applications)
- I E 460 (Service Systems Engineering)
- I E 462 (Introduction to Expert Systems)
- I E 463 (Computer Aided Design and Manufacturing)
- I E 464 (Assembly of Printed Circuit Boards)
- I E 466 (Concurrent Engineering)
- I E 467 (Facility Layout and Material Handling)
- I E 468 (Optimization Modeling and Methods)
- I E 470 (Manufacturing System Design and Analysis)
- I E 477 (Computer Control of Manufacturing Machines and Processes)
- I E 478 (Retail Services Engineering)
- I E 479 (Human Centered Product Design and Innovation)
- **MATSE 400** (Crystal Chemistry)
- **MATSE 402** (Materials Process Kinetics)
- MATSE 403 (Biomedical Materials)
- MATSE 404 (Surfaces and the Biological Response to Materials)
- MATSE 409 (Nuclear Materials)
- MATSE 410 (Phase Relations in Materials Systems)
- MATSE 411 (Processing of Ceramics)
- MATSE 412 (Thermal Properties of Materials)
- MATSE 413 (Solid-State Materials)
- MATSE 417 (Electrical and Magnetic Properties)
- MATSE 421 (Corrosion Engineering)
- MATSE 422 (Thermochemical Processing)
- MATSE 426 (Aqueous Processing)
- MATSE 430 (Materials Characterization)
- MATSE 435 (Optical Properties of Materials)
- MATSE 436 (Mechanical Properties of Materials)
- MATSE 440 (Nondestructive Evaluation of Flaws)
- MATSE 441 (Polymeric Materials)
- MATSE 443 (Introduction to the Materials Science of Polymers)
- MATSE 444 (Solid State Properties of Polymeric Materials)
- MATSE 445 (Thermodynamics, Microstructure, and Characterization of Polymers)
- MATSE 446 (Mechanical and Electrical Properties of Polymers and Composites)
- MATSE 447 (Rheology and Processing of Polymers)
- MATSE 448 (Polymer Processing Technology)
- MATSE 450 (Synthesis and Processing of Electronic and Photonic Materials)
- MATSE 455 (Properties and Characterization of Electronic and Photonic Materials)
- MATSE 475 (Particulate Materials Processing)

- MATSE 483 (Simulation and Design of Nanostructures)
- M E 400 (Thermodynamics of Propulsion and Power Systems)
- M E 401 (Refrigeration and Air Conditioning)
- M E 402 (Power Plants)
- M E 403 (Polymer Electrolyte Fuel Cell Engines)
- M E 404 (Gas Turbines)
- M E 405 (Indoor Air Quality Engineering)
- M E 406 (Introduction to Statistical Thermodynamics)
- M E 408 (Energy Systems)
- M E 410 (Heat Transfer)
- M E 411 (Heat-Exchanger Design)
- M E 420 (Compressible Flow)
- M E 421 (Viscous Flow Analysis and Computation)
- M E 422 Principles of Turbomachinery)
- M E 427 (Incompressible Aerodynamics)
- M E 428 (Applied Computational Fluid Dynamics)
- M E 430 (Introduction to Combustion)
- M E 431 (Internal Combustion Engines)
- M E 432 (Rocket Propulsion)
- M E 433 (Fundamentals of Air Pollution)
- M E 444 (Engineering Optimization)
- M E 446 (Reliability and Risk Concepts in Design)
- M E 448 (Engineering Design Concepts)
- M E 456 (Industrial Robot Applications)
- M E 460 (Advanced Machine Design Problems)
- M E 461 (Finite Elements in Engineering)
- M E 462 (Lubrication in Machine Design)
- M E 468 (Engineering for Manufacturing)
- M E 470 (Analysis and Design in Vibration Engineering)
- M E 471 (Noise Control in Machinery)
- M E 480 (Mechanism Design and Analysis)
- M E 481 (Introduction to Computer-Aided Analysis of Machine Dynamics)
- NUC E 401 (Introduction to Nuclear Engineering)
- NUC E 405 (Advanced Reactor Design)
- NUC E 406 (Introduction to Statistical Thermodynamics)
- NUC E 408 (Radiation Shielding)
- NUC E 409 (Nuclear Materials)
- NUC E 420 (Radiological Safety)
- NUC E 428 (Radioactive Waste Control)
- NUC E 430 (Design Principles of Reactor Systems)
- NUC E 446 (Reliability and Risk Concepts in Design)
- NUC E 450 (Radiation Detection and Measurement)
- NUC E 451 (Experiments in Reactor Physics)
- P N G 450 (Drilling Design and Production Engineering)
- P N G 475 (Petroleum Engineering Design)
- P N G 480 (Production Process Engineering)

Other Courses (select 0–2 courses)

- CHEM 212 (Organic Chemistry II)
- CHEM 402 (Chemistry in the Environment)
- CHEM 406 (Nuclear and Radiochemistry)
- CHEM 452 (Physical Chemistry - Quantum Chemistry)
- CHEM 466 (Molecular Thermodynamics)
- CHEM 472 (General Biochemistry I)
- F SC 431 (The Chemistry of Fuels)
- MATH 419 (Theoretical Mechanics)
- MATH 450 (Mathematical Modeling)
- MATH 461 (Theoretical Mechanics)
- METEO 421 (Atmospheric Dynamics)
- METEO 436 (Radiation and Climate)
- METEO 477 (Fundamentals of Remote Sensing Systems)
- PHYS 406 (Subatomic Physics)
- PHYS 410 (Introduction to Quantum Mechanics I)
- PHYS 411 (Introduction to Quantum Mechanics II)
- PHYS 412 (Solid State Physics I)
- PHYS 414 (Solid State Physics)
- PHYS 419 (Theoretical Mechanics)
- PHYS 421W (Research Methods in Physics)
- PHYS 443 (Intermediate Acoustics)
- PHYS 457W (Experimental Physics)
- PHYS 458 (Intermediate Optics)
- PHYS 461 (Theoretical Mechanics)
- PHYS 462 (Applications of Physics in Medicine)
- PHYS 472 (Elements of Nuclear Physics and its Applications to Medical Imaging and Treatments)

Only one of the following may be used to fulfill a technical elective requirement

- ENGR 295 + 395 + 495 — student must complete all three co-op rotations
- 3 credits of coursework required for a minor — student must complete the minor
- EDSGN 4xx (Solid Works/Advanced CAD)

Exceptions for technical electives not included on this list will be considered by department petition.

Note: Some of these courses may be enrollment controlled for students in that major. In these cases, please check with the specific department to determine their policy on letting studentsfromothermajorsenrollintheircourses.