# MECHANICAL & AEROSPACE ENGINEERING (MAE)

**MAE 180 International Course (1-12 Credits)**
*Engineering & Comp Sci*
Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the SU academic department to assign the appropriate course level, title, and grade for the student's transcript.
Repeatable

**MAE 200 Selected Topics (1-6 Credits)**
*Engineering & Comp Sci*
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.
Repeatable 6 times for 6 credits maximum

**MAE 251 Thermodynamics (3 Credits)**
*Engineering & Comp Sci*
Basic concepts in engineering thermodynamics. Thermodynamic properties of solids, liquids, and gases. First and second laws of thermodynamics. Reversible and irreversible processes. Entropy equation. Energy analysis of basic cycles.
Prereq: PHY 211 or 215
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 270 Experience Credit (1-6 Credits)**
*Engineering & Comp Sci*
Participation in a discipline or subject related experience. Student must be evaluated by written or oral reports or an examination. Permission in advance with the consent of the department chairperson, instructor, and dean. Limited to those in good academic standing.
Repeatable 6 times for 6 credits maximum

**MAE 280 International Course (1-12 Credits)**
*Engineering & Comp Sci*
Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the S.U. academic department to assign the appropriate course level, title, and grade for the student's transcript.
Repeatable

**MAE 284 Introduction to CAD (3 Credits)**
*Engineering & Comp Sci*
Fundamentals of projections and intersections of surfaces. Dimensioning and tolerancing. Different solid and surface modeling techniques. Use of a computer-aided design system. Design problems.
Prereq: ECS 101
Shared Competencies: Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

**MAE 290 Independent Study (1-6 Credits)**
*Engineering & Comp Sci*
Exploration of a problem, or problems, in depth. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor(s) and the department.
Repeatable

**MAE 300 Selected Topics (1-6 Credits)**
*Engineering & Comp Sci*
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.
Repeatable

**MAE 312 Engineering Analysis (3 Credits)**
*Engineering & Comp Sci*
Analytical and numerical methods of engineering problem solving. Linear algebra, ordinary and partial differential equations. Applications include vibration theory, column buckling, steady and unsteady heat transfer, subsonic and supersonic potential flows, wave propagation in rods.
Prereq: ECS 104 and MAT 485
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 315 Mechanical and Aerospace Engineering Laboratory (3 Credits)**
*Engineering & Comp Sci*
Laboratory experiments in engineering and science topics. Introduction to statistical evaluation of data. Experiments will be selected from various topics including solid mechanics, fluid mechanics, digital signal processing and vibrations.
Prereq: ECS 325; Coreq: MAE 341
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/); Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/); Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

**MAE 321 Dynamics of Mechanical Systems (3 Credits)**
*Engineering & Comp Sci*
Formulation of dynamics problems using Newton's Laws with an introductory study of analytical dynamics. Vibration of linear systems. Computational techniques for predicting system response.
Prereq: ECS 222 and ECS 325 and MAT 485
Shared Competencies: Scientific Inquiry and Research Skills (https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/)

**MAE 322 Control Systems for MAE (3 Credits)**
*Engineering & Comp Sci*
Review of Laplace transforms and z-transforms, system modeling, transfer functions, feedback, stability. Analysis and design using computer tools. Applications of controls to mechanical systems.
Prereq: MAT 485 Coreq: MAE 321
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 333 Data Analysis for Engineers (3 Credits)**
*Engineering & Comp Sci*
Collecting and pre-processing engineering data. Analysis of engineering data. Probability distributions and inferences. Estimation. Engineering experimental design. Engineering applications such as curve fitting, error analysis, statistical process control and reliability. Computational tools for data analysis.
Prereq: MAT 397
Shared Competencies: Information Literacy and Technological Agility (https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/)

**MAE 341 Fluid Mechanics (4 Credits)**
*Engineering & Comp Sci*
Dimensional analysis. Hydrostatics. Bernoulli's equation. Control volume analysis. Basic equations in differential form. Inviscid incompressible flows. Viscous flows in pipes and ducts. Estimation of head losses in fluid systems.
Prereq: ECS 221 and MAT 397 and (PHY 211 or 215)
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 355 Fundamentals of Heat Transfer (4 Credits)**
*Engineering & Comp Sci*
Principles of heat transfer: conduction, convection, and radiation. Thermal properties of materials. Boiling and condensation. Solutions of steady state and transient heat transfer problems. Design of heat exchange systems.
Prereq: MAE 341; Coreq: MAE 251
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 373 Analysis and Design of Structures (4 Credits)**
*Engineering & Comp Sci*
Elements of the plane theory of elasticity and strength of materials. Application to problems of mechanical and aerospace structures.

**MAE 380 International Course (1-12 Credits)**
*Engineering & Comp Sci*
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Repeatable

**MAE 400 Selected Topics (1-6 Credits)**
*Engineering & Comp Sci*
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.
Repeatable

**MAE 415 Mechanical and Aerospace Engineering laboratory III (2 Credits)**
*Engineering & Comp Sci*
Experiments in composite structures and instrumentation performed in small groups. Written and oral reports.

**MAE 433 Theory of Materials (3 Credits)**
*Engineering & Comp Sci*
Double-numbered with MAE 633
Introduction to basic science, fundamentals and properties of materials. Processes and analysis techniques for fabricating nano, micro, and macro devices. Additional work required of graduate students.
Prereq: ECS 326 or CEE 326
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 457 Automotive Engineering for ECS Students (3 Credits)**
*Engineering & Comp Sci*
An engineering study of the modern automobile, using a recent model car as a laboratory example. Analysis of engine, transmission, body, suspension, brakes, steering safety equipment, and fuel systems. FMVS Standards.
Prereq: MAE 251
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 470 Experience Credit (1-6 Credits)**
*Engineering & Comp Sci*
Participation in a discipline or subject related experience. Student must be evaluated by written or oral reports or an examination. Permission in advance with the consent of the department chairperson, instructor, and dean. Limited to those in good academic standing.
Repeatable

**MAE 473 Introduction to Finite Element Analysis (3 Credits)**
*Engineering & Comp Sci*
Introduction to formulation of mechanics and heat transfer problems by finite element analysis. Applications of the finite element method for the static and dynamic analysis of mechanical components and use of commercial software.
Prereq: MAT 485 and ECS 325

**MAE 480 International Course (1-12 Credits)**
*Engineering & Comp Sci*
Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the SU academic department to assign the appropriate course level, title, and grade for the student's transcript.
Repeatable

**MAE 483 Applied Environmental Acoustics and Noise Control (3 Credits)**
*Engineering & Comp Sci*
Double-numbered with MAE 683
Introductory to environmental acoustics, sound propagation, psychoacoustics, noise criteria for design, noise sources, absorption, noise isolation, design of critical spaces, sound measurement, vibration isolation, product noise ratings, sound quality.
Prereq: PHY 211
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 486 Fuel Cell Science and Technology (3 Credits)**
*Engineering & Comp Sci*
Fuel cell thermodynamics; electrode kinetics; performance and efficiency; transport process; types of fuel cells; fueling issues, and fuel cell systems and applications will be covered.
Prereq: MAE 251

**MAE 490 Independent Study (1-6 Credits)**
*Engineering & Comp Sci*
Exploration of a problem, or problems, in depth. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor(s) and the department.
Repeatable

**MAE 499 Honors Capstone Project (1-3 Credits)**
*Engineering & Comp Sci*
Completion of an Honors Capstone Project under the supervision of a faculty member.
Repeatable 3 times for 3 credits maximum

**MAE 500 Selected Topics (1-6 Credits)**
*Engineering & Comp Sci*
Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.
Repeatable

**MAE 510 Nuclear Reactor Design, Operation and Safety (3 Credits)**
*Engineering & Comp Sci*
Cross-listed with NUC 510
Principles of fission reactor analysis and design; reactor kinetics, operation and control; reactor thermo-fluid-dynamics; reactor safety; reactor accident case studies.
Prereq: NUC 301 and MAE 551

**MAE 512 Technology Management (3 Credits)**
*Engineering & Comp Sci*
This course develops a foundation for the concepts of ethics, technology life-cycles, product life cycles, concurrent engineering, managing people, project evaluation, leading technology teams, managing R&D and innovation and managing risks in order to support the planning, scheduling, and controlling activities required for successful completion of technologically innovative projects.
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/); Communication Skills (https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/)

**MAE 525 Soft Robotics: Materials, Mechanics, and Machines (3 Credits)**
*Engineering & Comp Sci*
Soft robotics offers many advantages over conventional robotics. This course explores relevant materials and mechanics for recent progress in soft robotics through lectures, literature surveys, and course projects where students work in teams to repeat part of recent soft robotics papers.
Advisory recommendation Prereq: ECS 325
Shared Competencies: Information Literacy and Technological Agility (https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/)

**MAE 530 Introduction to Design Optimization (3 Credits)**
*Engineering & Comp Sci*
Theory and use of numerical design optimization methods. Problem formulation, practical application, and results analysis. Unconstrained nonlinear problems, constrained linear and nonlinear problems, and multi-objective optimization. Graduate students will do additional work in surrogate models and optimizing under uncertainty. Extensive use of Matlab functions and programming.
Prereq: MAT 485
Shared Competencies: Information Literacy and Technological Agility (https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/)

**MAE 536 Composite Materials (3 Credits)**
*Engineering & Comp Sci*
Design, analysis, and manufacturing of fiber-reinforced composite materials. Emphasis is on polymeric composites for general aerospace and automotive applications, and on ceramic matrix composites for hypersonic applications.
Prereq: ECS 325
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 545 Applications of Fluid Mechanics (3 Credits)**
*Engineering & Comp Sci*
Selected topics in applied fluid mechanics, to be determined by the instructor. Tools employed include control volume analysis, Bernoulli equation, exact and simplified solutions of the Navier-Stokes equations, and test correlations.
Prereq: MAE 341

**MAE 548 Engineering Economics and Technology Valuation (3 Credits)**
*Engineering & Comp Sci*
Cross-listed with CEE 548
Value-based assessment and management of engineering/technology projects: equivalence; discounted cash flow; taxes/depreciation; financial statements. Risk-adjusted valuation: risk/uncertainty in staged projects; Monte Carlo simulations; decision trees; real options; project portfolio management.
Prereq: MAT 296
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 551 Energy Conversion (3 Credits)**
*Engineering & Comp Sci*
Cross-listed with CEE 551
Energy demand and resources. Fundamentals of combustion. Power plants, refrigeration systems. Turbines and engines. Advanced systems. Direct energy conversion. Alternate energy sources. Energy storage. Costs and environmental impact.
Prereq: MAE 251

**MAE 552 Building Environmental Measurements and Controls (3 Credits)**
*Engineering & Comp Sci*
Cross-listed with CEE 552
Fundamentals of building ventilating methods for measuring and controlling indoor environmental conditioning, thermal comfort, and indoor air quality.
Prereq: MAE 341 and 355

**MAE 553 HVAC Systems Analysis and Design (3 Credits)**
*Engineering & Comp Sci*
Cross-listed with CEE 553
Fundamentals of moist air properties, basic air conditioning processes, heat transfer in building structures, heating and cooling load calculations, and air distribution systems.
Prereq: MAE 251
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 554 Principles of Refrigeration (3 Credits)**
*Engineering & Comp Sci*
Basic thermodynamic analysis of refrigeration cycles. Components selection. Environmental issues and recent developments in the refrigeration and the air conditioning industry.
Prereq: MAE 251

**MAE 555 Fundamentals of Nano-Science & Nano-Engineering (3 Credits)**
*Engineering & Comp Sci*
Definition of nano-, micro- and macro- scales. Overview of nanotechnology. Molecular and surface forces at the nanoscale. Atomistic definitions of continuum properties. Molecular Simulations. Principles of nanofabrication. Characterization of nanomaterials. Additional paper for graduate students.
Prereq: PHY 212 and MAT 485

**MAE 571 Applications of Computational Fluid Dynamics (3 Credits)**
*Engineering & Comp Sci*
Use of commercial Computational Fluid Dynamics (CFD) softwares to solve problems of practical interest. Modeling of fluid/thermal systems. Introduction to CFD algorithms. Simulation, evaluation, and interpretation of CFD results.
Prereq: MAE 341
Shared Competencies: Information Literacy and Technological Agility (https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/)

**MAE 573 Application of Finite Element Analysis (3 Credits)**
*Engineering & Comp Sci*
Formulation of mechanics and heat transfer problems by finite element analysis. Application of the finite element method using commercial software in the static and dynamic analysis of mechanical components.
Prereq: ECS 325 and MAT 485
Shared Competencies: Information Literacy and Technological Agility (https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/)

**MAE 580 International Course (1-12 Credits)**
*Engineering & Comp Sci*
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Repeatable

**MAE 585 Principles of Turbomachines (3 Credits)**
*Engineering & Comp Sci*
Fluid dynamics and thermodynamics of turbomachines. Performance characteristics and analysis of axial and radial turbomachines. Cascade theory. Radial equilibrium equation. Meridional flow analysis. Three dimensional flow characteristics of turbomachines.
Prereq: MAE 251 and MAE 341
Shared Competencies: Critical and Creative Thinking (https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/)

**MAE 587 Design of Solar Energy System (3 Credits)**
*Engineering & Comp Sci*
Fundamentals of solar radiation, collectors and storage. Design of solar space heating, cooling; water heating systems. Study of solar electric systems. Economics of solar design; application to heat pumps, energy conservation techniques.
Prereq: MAE 251

**MAE 588 Principles of Wind Turbines (3 Credits)**
*Engineering & Comp Sci*
Cross-listed with CEE 588, ECS 588
Aerodynamics, performance, control, and electrical aspects wind turbines.
Prereq: MAE 341