

MECHANICAL & AEROSPACE ENGINEERING

Not all courses are offered every semester. Refer to the schedule of courses for each term's specific offerings.

More Info (<https://one.ufl.edu/soc/>)

Unless otherwise indicated in the course description, all courses at the University of Florida are taught in English, with the exception of specific foreign language courses.

Department Information

The Department of Mechanical & Aerospace Engineering (MAE) graduates many exceptional mechanical and aerospace engineers each year. The Mechanical Engineering program celebrated its 100 year anniversary in 2009 and is one of the founding departments of the Herbert Wertheim College of Engineering. Starting within mechanical as an aeronautical option, the Aeronautical Engineering program was founded in 1946. It grew to become the Aerospace Engineering program, which merged with Engineering Science and Mechanics in 1969. All these programs united (or reunited) in 2002. Going strong into the 21st century, MAE remains a vibrant and intellectually diverse program at both the undergraduate and graduate levels.

Website (<https://mae.ufl.edu/>)

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Map (<https://campusmap.ufl.edu/#/index/0033>)

Curriculum

- Aerospace Engineering
- Biomechanics Minor
- Combination Degrees
- Mechanical Engineering
- Sustainable and Resilient Energy Engineering Certificate

The prerequisites for all courses offered by the Department of Mechanical and Aerospace Engineering may require classification as a student in good standing in aerospace engineering, mechanical engineering, and/or another engineering program for which the particular course is required.

Courses

ATT 2100 Learn to Fly 3 Credits

Grading Scheme: Letter Grade

Science and engineering of flight. Preparation for FAA private pilot written exam. Underlying engineering principles of design, operation, and construction of aircraft. Aerodynamics, aerospace materials, structures, propulsion, aircraft instrumentation, stability and control, flight planning, safe aircraft operation, and pilot physiology.

Prerequisite: PHY 2048 with a minimum grade of C.

EAS 2011 Introduction to Aerospace Engineering 3 Credits

Grading Scheme: Letter Grade

Overview of aerospace engineering. Standard atmosphere, basic aerodynamics, airplane performance, stability and control, propulsion, and space flight.

Prerequisite: PHY 2048 or PHY 2060, with minimum grade of C.

EAS 4101 Aerodynamics 3 Credits

Grading Scheme: Letter Grade

Incompressible aerodynamics, integral and differential governing equations, potential flow, boundary layers, airfoils, wings, numerical techniques.

Prerequisite: (EAS 2011 or EAS 3020C or EGN 3353C) and COP 2271 and EML 3100 and MAC 2313 and MAP 2302 with minimum grades of C.

EAS 4132 Compressible Flow 3 Credits

Grading Scheme: Letter Grade

One-dimensional and quasi one-dimensional compressible fluid flows. Includes mach waves, normal shocks, oblique shocks, Prandtl-Meyer expansions, isentropic flow with area change, Fanno flow and Rayleigh flow.

Prerequisite: EAS 4101 or EGN 3353C

EAS 4200 Aerospace Structures 3 Credits

Grading Scheme: Letter Grade

Review of plane states of stress and strain. Includes analysis of thin-walled beams with open and closed section, unsymmetrical bending of wing sections, torsion of skin-stringer and multi-cell sections, flexural shear in open and closed sections, Shear Center and failure criteria. Also includes introduction to composite materials and demonstration of behavior of some simple structural elements.

Prerequisite: EGM 3520 with minimum grade of C.

EAS 4240 Aerospace Composites 3 Credits

Grading Scheme: Letter Grade

Various types and applications of structural composites used in flight structures. Also includes an introduction to analysis of structural composites.

Prerequisite: EGM 3520 with minimum grade of C.

EAS 4300 Aerospace Propulsion 3 Credits

Grading Scheme: Letter Grade

Basics of air-breathing and rocket engines used in flight systems.

Prerequisite: EAS 4132.

EAS 4400 Stability and Control of Aircraft 3 Credits

Grading Scheme: Letter Grade

Static stability and control, equations of motion, stability derivatives, stability of longitudinal and lateral motion of aircraft.

Prerequisite: EAS 4101 and EML 4312.

EAS 4412 Dynamics and Control of Space Vehicles 3 Credits

Grading Scheme: Letter Grade

Review of aerospace applications in current guidance and control systems. Includes synthesis of open and closed loop guidance and control systems using classical and modern control theory.

Prerequisite: MAP 4305 or MAP 5304.

EAS 4510 Astrodynamics 3 Credits

Grading Scheme: Letter Grade

Introduces the solar system. Includes study of two-body motion, Hohmann transfer, patched conics for interplanetary and lunar trajectories, and the restricted three-body problem. Also includes an introduction to powered flights and artificial satellite orbits.

Prerequisite: EGM 3401 with minimum grade of C and (MAP 4305 or MAP 5304).

EAS 4530 Space Systems Design 3 Credits

Grading Scheme: Letter Grade

A discussion of the component systems of a spacecraft and a typical mission's requirements. The operation and character of different spacecraft hardware is presented as well as typical mission timelines from early conception to final operations. Topics include the space environment, guidance/control/navigation systems, spacecraft sensors and actuators, propulsion systems, thermal systems, power systems, launch systems, communication systems, structural systems and mission operations. This course is useful to engineers, scientists, computer scientists and any profession that uses data.

Prerequisite: EAS 4510.

EAS 4700 Aerospace Design 1 3 Credits

Grading Scheme: Letter Grade

Applications of the principles of analysis and design to aerospace vehicles. Emphasizes astronautics.

Prerequisite: EAS 4510 and EML 4312 and EGM 3520.

EAS 4710 Aerospace Design 2 3 Credits

Grading Scheme: Letter Grade

Applications of the principles of analysis and design to aerospace vehicles. Emphasizes aeronautics.

Prerequisite: EAS 4101 and EAS 4400 and EGM 3520.

EAS 4810C Aerospace Sciences Lab and Design 3 Credits

Grading Scheme: Letter Grade

Experimental investigations of aerospace engineering systems. Wind tunnel testing. Design project with experimental validation.

Prerequisite: EAS 4101 and EAS 4132 and EML 3301C.

EAS 4905 Individual Study in Aerospace Engineering 1-4 Credits

Grading Scheme: Letter Grade

Selected problems or projects in the student's major field of engineering study.

Prerequisite: department chair recommendation.

EAS 4912 Integrated Product and Process Design 1 3 Credits**Grading Scheme:** Letter Grade

The first of a two-course sequence in which multidisciplinary teams of engineering and business students partner with industry sponsors to design and build authentic products and processes-on time and within budget. Working closely with industry liaison engineers and a faculty coach, students gain practical experience in teamwork and communication, problem solving and engineering design, and develop leadership, management and people skills.

Prerequisite: EAS 4101 and EGM 3520 and EML 3301C.**EAS 4913 Integrated Product and Process Design 2 3 Credits****Grading Scheme:** Letter Grade

The second part of the integrated design sequence in which multidisciplinary teams of engineering and business students partner with industry sponsors to design and build authentic products and processes-on time and within budget.

Prerequisite: EAS 4912.**EAS 4939 Special Topics in Aerospace Engineering 1-4 Credits****Grading Scheme:** Letter Grade

Special topics in aerospace engineering.

Prerequisite: Engineering major of junior standing or higher.**EAS 4949 Co-op Work Experience 1 Credit****Grading Scheme:** S/U

Practical engineering work under industrial supervision, as set forth in the college regulations.

Prerequisite: Engineering major of sophomore standing or higher.**EGM 2511 Engineering Mechanics: Statics 3 Credits****Grading Scheme:** Letter Grade

Reduction of force systems, equilibrium of particles and rigid bodies, vector methods and their application to structures and mechanisms.

Prerequisite: PHY 2048;**Corequisite:** MAC 2313.**EGM 3344 Introduction to Numerical Methods of Engineering Analysis 3 Credits****Grading Scheme:** Letter Grade

Methods for numerical solution of mathematical problems with emphasis on engineering applications using MATLAB. Includes roots, optimization, linear algebraic equations, matrices, curve fitting, differentiation, integration and ordinary differential equations.

Prerequisite: MAC 2313 and COP 2271;**Corequisite:** MAP 2302.**Attributes:** Artificial Intelligence**EGM 3401 Engineering Mechanics: Dynamics 3 Credits****Grading Scheme:** Letter Grade

Kinematics and dynamics of particles and rigid bodies in one, two, and three dimensions. Work-energy and impulse-momentum concepts.

Prerequisite: EGM 2511 and MAC 2313.**EGM 3520 Mechanics of Materials 3 Credits****Grading Scheme:** Letter Grade

Stress and strain at a point, stress-strain-temperature relations and mechanical properties of materials. Systems subject to axial load, torsion and bending. Design concepts, indeterminate structures and applications.

Prerequisite: EGM 2511 and MAC 2313.**EGM 4585 Modeling and Control of Biomolecular Machines 3 Credits****Grading Scheme:** Letter Grade

Overview of biomolecular systems engineering. Introduction to cell processes, biochemical kinetics, models of biological macromolecules, analyses of biomolecular dynamics, simulation of stochastic behaviors, common gene regulatory network motifs, and the design of synthetic biology circuits.

Prerequisite: MAP 2302 with a minimum grade of C.**EGM 4590 Biodynamics 3 Credits****Grading Scheme:** Letter Grade

Dynamic analysis of the human musculoskeletal system. Includes development of lumped mass, planar rigid body and 3-D rigid body models of human movement. Also includes calculation of internal forces in muscles and joints and analysis of muscle function using dynamics principles and musculoskeletal geometry.

Prerequisite: EGM 3400 or EGM 3401, or instructor permission.**EGM 4592 Bio-Solid Mechanics 3 Credits****Grading Scheme:** Letter Grade

Introduction to solid and fluid mechanics of biological systems. Includes rheological behavior of materials subjected to static and dynamic loading, the mechanics of cardiovascular, pulmonary and renal systems, and the mathematical models and analytical techniques used in biosciences.

Prerequisite: EGM 3520.

EGM 4853 Bio-Fluid Mechanics and Bio-Heat Transfer 3 Credits**Grading Scheme:** Letter Grade

A study of biothermal fluid sciences with an emphasis on the physiological processes occurring in human blood circulation and the underlying mechanisms from an engineering perspective.

Prerequisite: EGN 3353C.**EGN 3353C Fluid Mechanics 3 Credits****Grading Scheme:** Letter Grade

Statics and dynamics of incompressible fluids. Application to viscous and inviscid flows. Dimensional analysis. Compressible flow.

Prerequisite: MAC 2313 with a minimum grade of C and EGM 2511 and (EML 3100 or EML 3007 or BME 3060).**EGN 4912 Engineering Directed Independent Research 0-3 Credits****Grading Scheme:** S/U

Provides firsthand, supervised research with a faculty advisor or postdoctoral or graduate student mentor. Projects may involve inquiry, design, investigation, scholarship, discovery, or application.

Prerequisite: Department permission.**EMA 4450 Li-ion Next Generation Batteries 3 Credits****Grading Scheme:** Letter Grade

Qualities and reactions that characterize Li-ion batteries and other electrochemical cells. Emphasis on mechanical properties. Li-ion and Sodium-ion batteries, fuel cells, capacitors, and hydrogen storage.

Prerequisite: EGM 3520 with a minimum grade of C and EMA 3010.**EML 2023 Computer Aided Graphics and Design 3 Credits****Grading Scheme:** Letter Grade

Sketching, descriptive geometry, computer graphics, computer aided drafting and design projects.

EML 2322L Design and Manufacturing Laboratory 2 Credits**Grading Scheme:** Letter Grade

Study and application of design, problem formulation, conceptual design, prototype development. Study of common manufacturing processes.

Prerequisite: EML2023 & (Aerospace Engineering or Mechanical Engineering major).**EML 2920 Department and Professional Orientation 1 Credit****Grading Scheme:** Letter Grade

Principles of mechanical and aerospace engineering practice, professional standards, engineering ethics.

EML 3005 Mechanical Engineering Design 1 3 Credits**Grading Scheme:** Letter Grade

Design process, kinematics, gear trains, and standard mechanical components.

Prerequisite: COP 2271 and EML 2322L and EGM 3520 with a minimum grade of C and EGM 3401 with a minimum grade of C.**EML 3100 Thermodynamics 3 Credits****Grading Scheme:** Letter Grade

Application of the first and second laws of thermodynamics to closed and open systems and to cyclic heat engines. Includes the development of procedures for calculating the properties of multiphase and single-phase pure substances.

Prerequisite: (CHM 2045 or CHM 2095) and MAC 2313 and PHY 2048.**EML 3301C Mechanics of Materials Laboratory 3 Credits****Grading Scheme:** Letter Grade

Experimental characterization of the mechanical properties of engineering materials, precision instruments, computer-based data acquisition, statistical uncertainty analysis, preparation of engineering reports.

Prerequisite: EMA 3010 and (EGM 3520 with a minimum grade of C) and COP 2271 and (ENC 2256)**Attributes:** Satisfies 6000 Words of Writing Requirement**EML 4140 Heat Transfer 3 Credits****Grading Scheme:** Letter Grade

Steady state and transient analysis of conduction and radiation heat transfer in stationary media. Also discusses heat transfer in fluid systems, including forced and free convection.

Prerequisite: MAP 2302 with minimum grade of C and (EAS 4101 or EGN 3353C).**EML 4147C Thermal Sciences Design and Laboratory 3 Credits****Grading Scheme:** Letter Grade

Thermodynamics, fluid mechanics, and heat transfer integrated with design and laboratory.

Prerequisite: EML 3100 with a minimum grade of C and EML 3301C and EML 4140.**EML 4220 Vibrations 3 Credits****Grading Scheme:** Letter Grade

Single and multiple degree of freedom systems, including application to mechanical systems with problems employing computer techniques.

Prerequisite: EGM 3344 and EGM 3401 and EGM 3520 and MAP 2302 with minimum grades of C.

EML 4285 Off-Highway Vehicle Design 3 Credits**Grading Scheme:** Letter Grade

Design of off-highway vehicles and off-highway vehicle subsystems. Vehicle concepts, chassis, engines, transmissions, hydraulics. International perspectives.

Prerequisite: EGM 3520 with a minimum grade of C.**EML 4292 Microfluidics and BioMEMS 3 Credits****Grading Scheme:** Letter Grade

Introduction to concepts of miniaturization, materials, and methods for microfabrication, principles of microfluidics, and biological applications of microfluidic devices and biomedical microelectromechanical systems.

Prerequisite: EGN 3353C**EML 4312 Control of Dynamic Systems 3 Credits****Grading Scheme:** Letter Grade

Theory, analysis and design of control systems, including mechanical, electromechanical, hydraulic, pneumatic, thermal, and aerospace components and systems.

Prerequisite: EGM 3401 and EGM 3344 and MAP 2302 with minimum grades of C.**EML 4314C Dynamics and Controls System Design Laboratory 3 Credits****Grading Scheme:** Letter Grade

Experiments on dynamic systems in mechanical and aerospace engineering and design of relevant control systems.

Prerequisite: EML 3301C and EML 4312.**EML 4321 Manufacturing Engineering 3 Credits****Grading Scheme:** Letter Grade

Traditional and nontraditional manufacturing processes and equipment. Application of engineering analysis tools to manufacturing.

Prerequisite: EMA 3010 and EML 2322L and EML 3005.**EML 4416 Solar Energy Utilization 3 Credits****Grading Scheme:** Letter Grade

Fundamentals of solar radiation; basic heat transfer and thermodynamic topics with solar engineering applications; solar concentrating devices and flat plate solar absorbers; state of the art solar technologies, thermal storage, concentrating power generation systems, thermochemical storage, electrochemical storage technologies, photovoltaic systems.

Prerequisite: EML 3100 or equivalent.**EML 4450 Energy Conversion 3 Credits****Grading Scheme:** Letter Grade

Thermomechanical and thermoelectric energy conversion, conventional and unconventional techniques, and analysis of energy systems interactions.

Prerequisite: EML 3100 with a minimum grade of C and EGN 3353C and EML 4140.**EML 4461 Industrial Energy Management 3 Credits****Grading Scheme:** Letter Grade

Fundamentals of energy management: energy-policy-development, equipment energy usage (electric and thermal), process and equipment efficiencies, analyze industrial processes and optimize their energy use. Critical evaluation of new technology for use from technical and economical perspectives.

Prerequisite: EML 3100.**EML 4500C Reengineering Historic Machinery 3 Credits****Grading Scheme:** Letter Grade

Studies historic commercial machine or vehicle, including theory of operation, embedded engineering principles, and design. Reengineering and design of enhancements. Laboratory includes disassembly, observation of characteristics and conditions, implementation of enhancements, and rebuilding.

Prerequisite: EML 2322L and EML 3005 and EML 3100 with minimum grades of C.**EML 4501 Mechanical Engineering Design 2 3 Credits****Grading Scheme:** Letter Grade

Integrated design and presentation of a mechanical system.

Prerequisite: EML 4140 & EGN 3353C & EML 2322L & EML 3005 & (EGM 3401 with a minimum grade of C).**EML 4502 Mechanical Engineering Design 3 3 Credits****Grading Scheme:** Letter Grade

Design and realization of a mechanical engineering system, component, or process subject to appropriate standards and constraints. Team project.

Prerequisite: EML 4501 or EAS 4700 or EAS 4710;**Corequisite:** EML 4321.**EML 4507 Finite Element Analysis and Design 3 Credits****Grading Scheme:** Letter Grade

Stress-strain analysis and design of machine elements and finite element analysis.

Prerequisite: EGM 3344 and EGM 3520 and MAP 2302 with minimum grades of C.

EML 4535C Automation in Production Engineering 3 Credits**Grading Scheme:** Letter Grade

Design and manufacturing using computer numerical control (CNC) and automated techniques. Use of modern Computer Aided Manufacturing (CAM) methods to establish setup and manufacturing sequence. Focus on meeting functional, material, and tolerance requirements for each part of an assembly.

Prerequisite: EML 4501.**EML 4600 Refrigeration and Air Conditioning Fundamentals 3 Credits****Grading Scheme:** Letter Grade

Fundamentals of refrigeration theory, vapor compression and absorption, refrigeration components and systems, psychrometric theory, analysis of cooling and dehumidifying coils.

Prerequisite: EML 3100.**EML 4601 Heating and Air Conditioning System Design 3 Credits****Grading Scheme:** Letter Grade

Heating and air conditioning systems: equipment selection, system arrangement, load calculations, advanced psychrometrics, duct and piping system design, air distribution system design and indoor air quality.

Prerequisite: EML 3100.**EML 4722 Introduction to Computational Fluid Dynamics 3 Credits****Grading Scheme:** Letter Grade

General theory, skepticism, and practice of computational fluid dynamics. Computational grids and generation, boundary conditions, fluid dynamics, numerical methods, visualization, turbulence modelling, and various special topics.

Prerequisite: EAS 4101 or EGN 3353C**EML 4737 Hydronics and Pneumatics for Building Systems 3 Credits****Grading Scheme:** Letter Grade

Applications, design, maintenance and operations of various pneumatic, hydronic and other process systems. Includes in-depth design concepts and techniques as well as preparation of specifications and cost estimates.

Prerequisite: EGN 3353C.**EML 4842 Autonomous Vehicles 3 Credits****Grading Scheme:** Letter Grade

Methods and apparatus to automate vehicle navigation. Integration of sensors such as global positioning system (GPS), light detection and ranging (LIDAR), position encoders, inertial measurement units (IMU). Vehicle propulsion and steering. Python programming language, Linux operating system, robot operating system (ROS, ROS2). Autonomous navigation, obstacle avoidance, path planning, dead reckoning, vehicle localization.

Prerequisite: COP 2271 or COP 2273 or COP 2274.**Attributes:** Artificial Intelligence**EML 4905 Individual Study in Mechanical Engineering 1-3 Credits****Grading Scheme:** Letter Grade

Selected problems or projects in the student's major field of engineering study.

Prerequisite: 2.3 UF GPA and department permission.**EML 4912 Integrated Product and Process Design 1: Mechanical Engineering 3 Credits****Grading Scheme:** Letter Grade

The first part of a two-course sequence in which multidisciplinary teams of engineering and business students partner with industry sponsors to design and build authentic products and processes-on time and within budget. Working closely with industry liaison engineers and a faculty coach, students gain practical experience in teamwork and communication, problem solving and engineering design, and develop leadership, management and people skills.

Prerequisite: EGN 3353C and EGM 3401 and EML 3005 and EML 3301C.**EML 4913 Integrated Product and Process Design 2: Mechanical Engineering 3 Credits****Grading Scheme:** Letter Grade

The second part of the integrated design sequence in which multidisciplinary teams of engineering and business students partner with industry sponsors to design and build authentic products and processes-on time and within budget.

Prerequisite: EML 4912.**EML 4914 Undergraduate Realization Thesis 3 Credits****Grading Scheme:** Letter Grade

Individualized study that realizes a design under the supervision of a faculty mentor. Realization considers all steps in the design process with major focus on prototyping, testing, evaluation, and optimization. The student produces a written thesis that is defended orally.

Prerequisite: EML4501 or EAS4700 or EAS4710.

EML 4926 Mechanical Consulting Practice 3 Credits**Grading Scheme:** Letter Grade

Synthesis and analysis of mechanical engineering systems, planning and execution of engineering contracts, and supervision of construction and tests.

Prerequisite: Senior standing or higher.**EML 4930 Special Topics in Mechanical Engineering 1-3 Credits****Grading Scheme:** Letter Grade

Variable content in mechanical engineering not offered in other courses.

Prerequisite: Engineering major of junior standing or higher.**EML 4945 Practical Work in Mechanical Engineering 1 Credit****Grading Scheme:** S/U

Practical engineering work under industrial supervision, as set forth in the Herbert Wertheim College of Engineering regulations.

Prerequisite: Engineering major with a 2.0 UF GPA.**EML 4949 Co-op Work Experience 1 Credit****Grading Scheme:** S/U

Practical co-op work experience under approved industrial supervision.

Prerequisite: Engineering major with a 2.0 UF GPA.
