Mechanical Engineering Technical Electives

Note: The purpose of this document is to provide students with a general idea as to what semesters the technical electives tend to be offered. Please be advised that course offerings are contingent upon departmental resources, so not every course will be offered in the semester in which it is listed. Also, you will notice that EML 4930 is used for a myriad of special topic technical electives, which may vary by semester.

Course Code	Course Title	Fall	Spring
EML 4930	**Robotic Systems** The purpose of this course is to understand the science and engineering of mechanical manipulation from the prospective of Kinematics. This course requires basic knowledge in statics, dynamics, linear algebra, and higher-level programming. Students will use MATLAB, Python and/or Robotics Operating System (ROS) to work on homework and projects. An introductory controls course is desired but not necessary. **Prerequisites:** EGN 3321 and EML 3500 **Instructor:** Dr. Redwan Alqasemi	X	
EML 4930	**Rehabilitation Engineering** The purpose of this course is to introduce engineering principles and provide a foundation in rehabilitation engineering, a field dedicated to maximizing the health and well-being of people with disabilities through technology. **Prerequisites**: EGN 3343 and EML 3500 **Instructor:** Dr. Stepanie Carey		X
BME 4440	**Intro to Bioastronautics** This course will discuss the space environment, impacts of microgravity on human physiology, countermeasures, human factors in spacesuit and spacecraft design, astronaut training, life support systems, mission planning, and private space flight. **Prerequisite**: EGN 3343 **Instructor:** Dr. Stephanie Carey	X	
EML 4536	**Applied FEA** Theory and practical applications of Finite Element Method, Matrix methods, Linear and Non-linear structural analysis of Trusses, Beams, Frames and three-dimensional machine components/assemblies. Buckling and modal analysis. ANSYS/Solidworks simulations. **Pre/Corequisite**: EML 4501 **Instructor:** Dr. Ajit Mujumdar	X	X

EML 4542	**Materials Selection** This course will cover advanced concepts and strategies of materials selection for any type of engineering design. Engineering materials and their properties are explored using the Ashby Materials Selection Charts. Case studies of materials selection in design with metals, ceramics, polymers, and composites are presented. The course introduces analytical tools and methods for material selection. Modern material selection software "Cambridge Engineering Selector" will be applied to material and process selection. **Prerequisites:** EGN 3365, EML 3500 and EGN 3343 **Instructor:** Dr. Ipek Yucelen	X	X

EML 4450	**Alternative and Renewable Energy** An overview of energy conversion for electrical power generation and transportation, both conventional and sustainable. The course is aimed at mechanical engineering seniors and includes hands-on design projects. **Prerequisites**: EGN 3343 and EML 3500 **Instructor**: TBD		
EML 4601	**A/C Design** Application of thermodynamics, heat transfer, and fluid flow to sizing of HVAC systems. Heating and cooling calculations, air requirements, equipment sizing. Energy Code requirements. Design project. **Prerequisites**: EGN 3343 and EML 3500 **Instructor**: TBD		
OSE 4601	**Optical Product Technology** Overview of the operating principles, design, and mechanical construction of a broad range of optically based products. The course is aimed at mechanical engineering seniors and includes hands-on design projects. **Prerequisites**: EGN 3343 and EML 3500 **Instructor**: TBD		
EML 4575	**Principles of Fracture Mechanics** Introduction of failure and fracture of linear and nonlinear engineering materials, as well as designing against fracture in modern materials. **Prerequisites**: EGN 3343 and EML 3500 **Instructor**: Dr. Alex Volinksy		X

EML 4310	**Microcontrollers** To introduce students to microcontroller technology, and to provide them with an understanding of the concepts and principles used to interface input and output devices to microcontrollers, program microcontrollers, and to develop applications. **Pre/Corequisite:** EML 4312 **Instructor:** Dr. Daniel Hess	X	X
EML 4593	**Haptics** Course covers the theory and implementation of haptic interfaces and rendering, teleoperation, modeling, control and stability of feedback for robotic systems and virtual environments, and the related human haptic sensing capabilities. **Prerequisites**: EML 3041 and EML 4312 **Instructor:** Dr. Kyle Reed		X
EML 4503	**Sustainable Design and Materials** This course integrates sustainability into the design of engineered products. Topics include materials selection and function performance, design for the 4 Rs, end-of-life concerns and product life cycle assessment methods. **Prerequisite**: EML 4501 **Instructor:** Dr. Nancy Diaz-Elsayed		X
EML 4905	**Independent Study** Specialized independent study determined by the student's needs and interests. ***The following form must be submitted for your Independent Study: https://www.usf.edu/engineering/me/documents/independentstudycontract.pdf***	X	X

EML 4552	**Senior Mechanical Design** Comprehensive design or feasibility study project. In some cases, may be a continuation of EML 4501. ***The following form must be submitted for your Senior Mechanical Design to be approved: https://www.usf.edu/engineering/me/documents/seniormechanicaldesigncontract.pdf*** **Prerequisite:** EML 4501	X	X

EML 4930	**Advanced CAD/CAM** The purpose of this course is to understand and be proficient in using the advanced features, capabilities, and practical applications of CAD and CAM, a 3D feature-based solid modeling software, Solidworks. Students will be prepared to work in the design and manufacturing industry by assisting in getting certified with a Professional level of Design (CSWP – Mechanical Design) and Manufacturing (CSWP – CAM). The additional bonus is to get certified at the Associate level of Additive Manufacturing (CSWA-Additive Manufacturing). **Prerequisite**: EML 3022 **Instructor:** Dr. Ajit Mujumdar		
EML 4940	**Industry Internship** Individual study as practical mechanical engineering and similar areas-related work under industrial supervision with faculty approval and assessment **Prerequisites**: EGN 3343 and EML 3500 **Instructor:** Dr. Ajit Mujumdar *Considered as an outside-department tech elective*	X	X
EML 4930	**Micro Electromechanical Systems (MEMS)** Introduction to the field of microelectromechanical systems (MEMS), including transducer performance metrics, theoretical modeling of devices, microfabrication processes, and optimization. **Prerequisite:** Electrical Systems (EGN 3373) **Pre/Corequisite:** Vibrations (EML 4220) **Instructor:** Dr. Brett Freidkes	X	
EML 4930	**Supersonic and Hypersonic Flow** Principles of compressible fluid flow; normal and oblique shocks; nozzles and diffusers; shock tubes; conical flow; introduction to 3D flow; method of characteristics; introduction to compressible boundary layers; introduction to transonic and hypersonic flows **Prerequisite**: EML 3701 **Instructor:** Dr. Anshuman Pandey	X	
EAS 4101	**Fundamentals of Aerodynamics** Incompressible aerodynamics, integral and differential governing equations, potential flow, boundary layers, airfoils, wings, and numerical techniques. **Prerequisites**: EML 3041 and EML 3701 **Instructor:** Dr. Sonya Tiomkin	X	

EAS 4020	**Introduction to Flight** Introduction to the science and engineering of aircraft. Overview of applied aerodynamics, performance, stability, propulsion, and structures. **Prerequisites**: EGN 3343, EML 3500 and EML 3035 **Instructor:** Dr. Sonya Tiomkin		X
EML 4419	**Propulsion** Introduction to the design of propulsion systems. Basic analysis of internal combustion, jet and rocket engines. Application to ground and air transportation. Advanced propulsion concepts. Special topics for class discussion **Prerequisites**: EML 3701 and EML 3500 **Instructor:** Dr**.** Ahmadreza Vaselbehagh		X
EML 4230	**Introduction to Composite Materials** The course introduces manufacturing types and applications of advanced composites. Students study micromechanical and macromechanical behavior of a lamina and analyze and design a laminated structure made of advanced composite materials. **Prerequisites**: EML 3500 and EML 3041 **Instructor:** Dr. Autar Kaw		X
EML 4914	**Advanced Undergraduate Research Experience** This class is a supervised research experience offered for undergraduates in Mechanical Engineering **Prerequisites:** EML 3500 and EGN 3343	X	X

For the special topics tech electives (EML 4930), please request a course permit here: https://usf.az1.qualtrics.com/jfe/form/SV_5d7iak2ptL4OI6h. The permit request form can also be found on our departmental website.

Outside-Department Technical Electives

Note: Students are permitted to register for one technical elective that does not fall within the Mechanical Engineering department. You must contact that respective department to obtain a permit. The courses listed below do not require pre-approval, but if a course is not listed here, you must obtain approval from a department advisor. All courses are subject to availability.

Course Code	Course Title	Fall	Spring	Summer	Dept.
CES 3102	**Structures I** Analysis of simple structural systems, both determinate and indeterminate. Moment area theorems; influence lines; introduction to steel design.		X	X	Civil
ENV 4001	**Environmental Systems Engineering** Introduction to environmental engineering. Protection of human health, air, water, and land resources. Sustainable design, water quality, solid and hazardous waste management, air quality control, contaminated environments. Application of mass balances.	X	X		Civil
EEL 4936 /4935	**Make: Hands-On Engineering** Inspired by the 'Maker Movement', the objective of the Make course is to introduce students to the creative design and manufacturing of devices following the engineering design process. The course will teach students the essential skills needed for the design of "mechatronic" devices (i.e. devices incorporating electronic, mechanical and software-based components). Students will learn the use of 3D design software, the programming of a micro controller (Arduino), and to build electronic control circuits. The course will be taught through direct hands on instruction in the classroom. All students will design and build a prototype device during this course. The course will also introduce to modern manufacturing processes such as 3D printing and laser cutting, and give an introduction to project planning and cost estimation.	X	X		Electrical
EGN 3375	**Electromechanical Systems** Analysis of electromechanical device performance: transformers, transducers, DC motors and generators, motors and alternators.	X	X		Electrical
ECH 3702	**Instrument Systems I** Basic concepts of electric circuits and their applications. Resistors, capacitors, inductors, logic operations, junction devices. Programmable Logic controllers, ladder diagrams.	X	X		Chemical
ECH 4931	**Modern Biomedical Technologies** Biomedical technologies broadly refer to applications of state-of-the-art engineering practices and emerging technologies to medicine and biomedical systems. In this course, major advances in modern Biomedical technologies will be addressed. You will learn about new possibilities brought by development of interfaces between human body and computers, creation of artificial body parts, deciphering of brain signals, design of new generation biomedical instruments, and many other interesting topics.	X			Chemical
ESI 4244	**Design of Experiments** Activity forecasting models and control. Design and use of inventory control models, both designs applicable to engineering analyses. Analysis of variance and regression.	X			Industrial
EIN 4601C	**Automation and Robotics** Introduction to the practices and concepts of automation as applied to material handling, inventory storage, material transfer, industrial processes and quality control		X		Industrial

EIN 4178	**ISO 9000/14000** This course covers analysis of ISO 9000 and ISO 14000 publications with a view towards understanding the documentation process, auditing for registration purposes, and the relationship to the quality systems and programs.			X	Industrial
EIN 4142	**Project Management** Provide principles and techniques for planning, scheduling and managing projects in engineering and related environments. Applies analytical tools and techniques including software to solve project management problems.		X		Industrial
EIN 4180	**Principles of Engineering Management** Emphasis is placed on management practice in an engineering-intensive context. Topics include management theory, planning and control, strategic management, organizing, ethics, leadership, innovation and change, and communication skills		X		Industrial
EIN 4453	**Advanced Lean Six Sigma** Advanced Lean Six Sigma expands upon initial exposure to lean six sigma knowledge of available statistical tools and techniques. It carries the service-learning designation and includes a compulsory project where learned concepts are applied.	X			Industrial
EIN 4173	**Quality Management Systems** This course presents the functions and responsibilities of the quality organization. Quality Management Systems concepts and tools for continuous improvement, include Baldrige Criteria, ISO 9000, and 6- Sigma, are analyzed for sequence of use and application		X		Industrial
EIN 4200	**Creativity in Technology** This course is designed to aid in re-opening the creativity within ourselves so that each life can be a work of art. Exploration and discovery of the individual's higher SELF helps to develop their complete potential and creativity in all parts of life	X			Industrial
BME 4100	**Introduction to Biomedical Engineering** An overview of biomedical engineering, including material and energy balances on human subjects, biomechanics, biomaterials, cellular and tissue engineering, biomedical imaging, neuro-engineering, cardiovascular systems, nanomedicine, drug delivery, engineering ethics, intellectual property and product development.	X	X		Biomedical