# 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 topics technical electives, which may vary by semester.*

| Course Code | Course Title | Fall | Spring |
|---|---|---|---|
| **EML 4930** | **Leadership in Engineering**<br><br>Leadership in Engineering is a multi-discipline class that involves readings about leadership and extensive in-class team exercises for developing and improving leadership and teamwork competencies. The course is intended to increase awareness of these competencies, to introduce concepts and methods applicable to working in and leading teams, and to strengthen the ability to apply that knowledge.  The objective is to prepare the student for participating in or leading a team in a business setting.<br><br>**Note: *You must contact Michelle King (mking77@usf.edu) to obtain a permit for this course.*** | X | X |
| **EML 4930** | **Rehabilitation Engineering**<br><br>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. | X | |
| **BME 4440** | **Intro to Bioastronautics**<br><br>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. | | X |
| **EML 4536** | **Applied FEA**<br>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. | X | X |
| **EML 4930** | **Materials Selection**<br><br>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. | X | X |

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|---|---|---|---|
| **EML 4450** | **Alternative and Renewable Energy**<br><br>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 | X | |
| **EML 4601** | **A/C Design**<br><br>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. | X | |
| **OSE 4601** | **Optical Product Technology**<br><br>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. | | X |
| **EML 4575** | **Principles of Fracture Mechanics**<br><br>Introduction of failure and fracture of linear and nonlinear engineering materials, as well as designing against fracture in modern materials. | | X |
| **EML 4310** | **Microcontrollers**<br><br>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. | | X |
| **EML 4593** | **Haptics**<br><br>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. | | X |
| **EML 4905** | **Independent Study**<br><br>Specialized independent study determined by the student's needs and interests.<br><br>*The following form must be submitted for your Independent Study:*<br>*https://www.usf.edu/engineering/me/documents/independentstudycontract.pdf* | x | x |
| **EML 4552** | **Senior Mechanical Design**<br><br>Comprehensive design or feasibility study project. In some cases, may be a continuation of EML 4551.<br><br>*The following form must be submitted for your Senior Mechanical Design to be approved:*<br>*https://www.usf.edu/engineering/me/documents/seniormechanicaldesigncontract.pdf* | x | x |

## Non-Mechanical Engineering 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 an approval from a department advisor. All courses are subject to availability.*

| Course Code | Course Title | Fall | Spring | Summer | Dept. |
|---|---|---|---|---|---|
| CES 3102 | **Structures I**<br><br>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**<br><br>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**<br><br>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**<br><br>Analysis of electromechanical device performance: transformers, transducers, DC motors and generators, motors and alternators. | X | X | | Electrical |
| ECH 3702 | **Instrument Systems I**<br><br>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**<br><br> 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**<br><br>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**<br><br>Introduction to the practices and concepts of automation as applied to material handling, inventory storage, material transfer, industrial processes and quality control | | X | | Industrial |

| Course | Description | Col1 | Col2 | Col3 | Area |
|---|---|---|---|---|---|
| **EIN 4178** | **ISO 9000/14000**<br><br>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**<br><br>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 4453** | **Advanced Lean Six Sigma**<br><br>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 |