Engineering

School

School of Science, Engineering and Technology (http://www.stmarytx.edu/set/)

School Interim Dean

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Department

Engineering (https://www.stmarytx.edu/academics/department/engineering/)

Department Chair

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Engineering

The Engineering programs at St. Mary’s University are known for high academic standards and innovative Senior Design Projects.

The curriculum emphasizes important areas in the respective engineering fields and exposes students to state-of-the-art engineering tools including hardware and software.

Students get a special blend of classroom learning and hands-on engineering practice, creating technical leaders who are able to “engineer the greater good” for the society.

St. Mary’s focuses on educating the whole individual by integrating liberal arts and professional education. Our institution promotes student development in the context of the larger community, preparing students for success not only in their engineering careers, but also in all aspects of their lives. Education of the whole person is an important trait of the Marianist education philosophy that we follow in our engineering programs.

Annual Enrollment and Graduation of Accredited Programs

The Bachelor of Science degree program in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (http://www.abet.org/)

The Bachelor of Science degree program in Electrical Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (http://www.abet.org/)

The Bachelor of Science degree program in Industrial Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (http://www.abet.org/)

The Bachelor of Science degree program in Mechanical Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (http://www.abet.org/)

Student Learning Outcomes

The student outcomes that prepare graduates to attain the program educational objectives are:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Majors in Engineering

- B.S. in Computer Engineering (https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/engineering/computer-engineering/)

- B.S. in Electrical Engineering (https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/engineering/electrical-engineering/)
- B.S. in Engineering Management (https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/engineering/engineering-management/)
- B.S. in Engineering Science (https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/engineering/engineering-science/)
- B.S. in Industrial Engineering (https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/engineering/industrial-engineering/)
- B.S. in Mechanical Engineering (https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/engineering/mechanical-engineering/)
- B.S. in Software Engineering (https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/engineering/software-engineering/)

All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a “C” or better in order to advance to the next sequenced course.

EG 1113. C Programming for Engineering Lab. 1 Semester Hour.
The lab focuses on use of editors, compilation, debugging, basic C programs, string manipulation, file management, conditional statements, switch case, loops, arrays, functions, files, command line arguments, string manipulations. (Spring) Corequisite: EG1213.

EG 1122. MATLAB Programming. 1 Semester Hour.
The course focus on MATLAB and its application to engineering problems, including M-file and its debugging features, flow control in MATLAB, more advanced usage of MATLAB help utilities and commands, toolboxes, solving advanced engineering and scientific problems using MATLAB, and advanced graphing capabilities of MATLAB. (Spring) Prerequisite: EG1213.

EG 1141. Mechanical Eng. Fund Workshop. 1 Semester Hour.
Introductory laboratory to study systems and phenomena of interest to mechanical engineering. It requires the planning and designing of the experiments, and construction of mechanical systems, where the students apply concepts of mathematics, physics, and other sciences. The analysis of data and presentation of results will be required. (Fall) Prerequisite: none.

EG 1194. Python Programming for EG Lab. 1 Semester Hour.
The lab focuses on developing applications using Python and basic programming skills, including control structures, data types and data structures, search and sort, modularization using functions, recursion, use of external libraries, runtime error handling, debugging, file input/output, and scientific calculations. Students develop Python applications to solve problems in different fields of engineering, such as visualizing fractals, simulating physical mechanics, image analysis and compression, and sound synthesis. (Spring) Corequisite: EG1294.

EG 1213. C Programming for Engineering. 2 Semester Hours.
The goal of this course is to provide students with a working knowledge of C programming language as defined by the ANSI standard. This class does not just focus on the C language syntax and program constructs. It will also emphasize good programming habits in developing a well-structured code. The concepts that will be presented in this course include programming environment; basic C program structure; variables, constants, and operators; looping with for, while, and do while statements; decision-making constructs (if, if/else, switch, and conditional expression statements); using and writing functions; using arrays, pointers, and combination thereof; string operations/functions; performing file I/O; using the preprocessor directives; and using modular development methodology. (Fall; Spring) Prerequisite: none.

EG 1241. Fundamentals of Mechanical Engineering. 2 Semester Hours.
This course introduces students to the diverse fields of mechanical engineering, including design, manufacturing, power, thermofluids, robotics, aerospace, mechatronics, biomechanics, and renewable energy. It also provides hands-on training with essential workshop equipment, covering fundamental manufacturing processes such as casting, welding, metal cutting, and metal forming. Students will design and construct mechanical components, gaining practical skills in operating various machines and understanding their applications in engineering. (Spring and Fall) – PreReq: None, CoReq: EG 1341.

EG 1294. Python Programming for Eng. 2 Semester Hours.
Students will study the Python language and basic programming skills, including control structures, data types and data structures, search and sort, modularization using functions, recursion, use of external libraries, runtime error handling, debugging, file input/output, and scientific calculations. Students design Python programs to solve problems in different fields of engineering, such as visualizing fractals, simulating physical mechanics, image analysis and compression, and sound synthesis. (Spring) Prerequisite: none.

EG 1303. Engineering and Society. 3 Semester Hours.
This course introduces students to the engineering profession and its role in addressing and solving contemporary global and societal challenges. Students will explore the application of engineering concepts, principles, and tools to creatively solve problems while considering public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. Students will be exposed to ethical and professional responsibilities in engineering decision-making, and learn to exercise critical thinking, presentation and writing skills. This course is open to all university majors. (Fall; Spring) Prerequisite: none.

EG 1316. Object-Oriented Programming and Design. 3 Semester Hours.
Introduction to object-oriented programming and design. Classes, objects, data members (class attributes), methods (member functions or class behavior), compilers, IDEs, and standard library. Object-oriented analysis and design methodologies and their role in the software development process. Object-oriented programming principles: data abstraction, encapsulation, inheritance, and polymorphism. Software reuse. The Unified Modeling Language (UML) as a design and development tool. Hands-on programming is emphasized with programming assignments. (Spring) Prerequisite: EG1213 or CS 1310.

EG 1341. Graphics and Design. 3 Semester Hours.
Brief introduction to the history of drawing. Introduction to drawing instruments, lettering, and the sketching process. Development of perceptual and conceptual drawing skills through a variety of approaches, including sighting, contour line, and compositional studies. Elaboration of work drawings: pictorials, orthographic projection, dimensioning, sections, and auxiliary views. Descriptive geometry: points, lines, planes, revolutions, intersections, etc. Utilization of CAD software. Introduction to the engineering design process and development of basic design projects. The course is open to all university majors. (Fall; Spring) Prerequisite: none.

EG 2113. Logic Design Laboratory. 1 Semester Hour.
This lab introduces the basic principles of digital electronics design using standard TTL devices. Experiments illustrate the principles learned in the Fundamentals of Logic Design (EG 2313) class. The first part of this laboratory focuses on the design of combinational networks. This includes the basic operation of various logic gates; verification of truth tables; minimization of logic functions; realization of digital functions using multiple stage networks, decoders, multiplexer, and read-only memory. The second part of this lab emphasizes the design of sequential network. Here, students are introduced to various types of flip-flops, counters; design of digital circuits using Finite State Machines. Writing intensive course. (Fall) Corequisite: EG2313.

EG 2121. Circuit Analysis Laboratory. 1 Semester Hour.
This hands-on laboratory course reinforces the theoretical principles covered in circuit analysis through practical experimentation. Students will validate key electrical theorems and laws, such as Ohm’s Law, Kirchhoff’s Voltage and Current Laws (KVL/KCL), Thevenin’s and Norton’s Theorems, using real-world measurements and simulations. The course emphasizes proficiency in the use of standard electrical laboratory equipment, including oscilloscopes, function generators, DC power supplies, and digital multimeters. Students will explore DC and AC circuit behavior, including transient and steady-state responses in first-order (RC and RL) and second-order (RLC) circuits. Additional topics include frequency response analysis, resonance in RLC circuits, operational amplifier (op-amp) applications, and basic filter design. Students are expected to design circuits in multiSIM before implementing them on a breadboard to enable comparison of simulated and experimental results. This is a writing-intensive course. (Fall) Corequisite: EG 2321.

EG 2123. Circuits and Systems Lab. 1 Semester Hour.
This course uses Multisim simulation software to analyze basic electrical circuits using, power sources, multimeters, oscilloscope, resistors, inductors, capacitors, purely resistive circuits, RL, RC and RLC circuits. Finding transient and steady state response of RL, RC, and RLC circuits. Performing the above-mentioned tasks with actual circuits. Preparing professional technical reports. (Fall; Spring) Corequisite: EG 2323 (either a prerequisite or a corequisite).

EG 2126. Electronics I Laboratory. 1 Semester Hour.
This comprehensive lab integrates foundational and advanced topics in electronics through hands-on experimentation. Students will explore DC and AC circuit behavior, nonlinear devices such as diodes and transistors. Lab experiments include rectifiers, clamping and filtering circuits, transistor biasing and switching, common-emitter and emitter-follower amplifiers, current sources and mirrors, FET-based configurations, open-loop and closed-loop configurations, integrators, differentiators, and active rectifiers. Additional topics include analog switches, sample-and-hold circuits, comparators, Schmitt triggers, and phase-locked loops. (Fall) Corequisite: EG 2326: Electronics. Prerequisite: EG 2121: Circuit Analysis Lab.

EG 2143. Machining and Prototyping Lab. 1 Semester Hour.
Introductory laboratory to give engineering undergraduates the opportunity to engage in machine shop operation under the supervision of qualified machine shop personnel. Students learn to operate a diverse number of machines. Students are required to construct a basic machine element using the machining techniques learned. (Fall) Prerequisite: EG1341.

EG 2311. Software Requirement Engineering. 3 Semester Hours.
This course provides an introduction to the fundamentals of software requirements management. Topics covered include requirements gathering, system modeling and software specifications. The major emphasis is on using a variety of modeling tools and techniques to define a system specification. Languages and models for representing requirements. Analysis and validation techniques, including need, goal, and use case analysis. Students participate in a group project on software requirements. (Spring only) Pre-requisite: none.

EG 2312. Data Structures and Algorithms. 3 Semester Hours.
This course builds on students' prior knowledge of programming and mathematics, introducing advanced techniques for designing and analyzing data structures and algorithms. Students will learn to evaluate and implement key data structures and algorithms used in modern operating systems, application programs, and other computational systems. Emphasis is placed on practical problem-solving, efficiency analysis, and real-world applications, equipping students with the skills to develop optimized solutions for engineering and software development challenges. (Spring) Prerequisites: MT2323 and either EG1213 or CS1310.

EG 2313. Fundamentals of Logic Design. 3 Semester Hours.
The first half of this course focuses on combinational network design. This includes the number systems and conversion; Boolean algebra; minimization of switching functions using Karnaugh maps; multi-level gate networks; multi-output networks; realizing Boolean functions using multiplexers, decoders, read-only memories, and programmable logic devices. The second half of this course focuses on the analysis and the design of sequential network. Topics covered in this part of the course include flip-flops; designing counters using different type of flip-flops; analysis of sequential networks; derivation of state graphs and tables; introduction to Finite State Machines; minimization of state tables; guidelines for state assignment; derivation of flip-flop input equations, and realization of sequential networks. (Fall) Prerequisite: none. Co-requisite: EG 2113.

EG 2321. Circuit Analysis I. 3 Semester Hours.
This course provides students with a foundational understanding of electricity essential for circuit design and analysis. The course covers fundamental circuit elements and their models, resistive circuits, and key circuit theorems. Students will learn loop and nodal analysis techniques for resistive networks, as well as methods for analyzing operational amplifiers. Additionally, the course explores circuits containing energy storage elements, including capacitors and inductors, and examines the natural and step responses of RL, RC, and RLC circuits. (Fall) Prerequisite: PY2404 and MT2413.

EG 2323. Circuits and Systems. 3 Semester Hours.
This course provides a comprehensive introduction to the principles of electric essential for the design and analysis of electrical circuits. Topics include the theory and applications of electrical components, such as resistors, inductors, and capacitors. Students will explore electrical units and measurement techniques, circuit analysis laws such as KVL, KCL, OHM, nodal and mesh analysis, operational amplifiers, and the transient response of RL, RC, and RLC circuits. (Fall; Spring) Prerequisites: PY2404 MT2413.

EG 2324. Circuits Analysis II. 3 Semester Hours.
The goal of this course is to provide students with a working knowledge of phasor diagrams; sinusoidal steady-state power analysis and complex load matching; series and parallel resonance; Laplace transform and its applications in circuit analysis: the step function, the impulse function, inverse transforms, initial and final value theorems, and circuit analysis in the s-domain. Transfer functions and Bode diagrams are also included. (Spring) Prerequisite: EG 2321.

EG 2326. Electronics. 3 Semester Hours.
Circuit models used for diodes. DC analysis and design of diode-based switching circuits. AC behavior of diodes including AC to DC conversion, small signal model and other AC circuits. DC behavior of Metal-Oxide-Semiconductor-Field-Effect transistors (MOSFET) and their application in circuits. AC application of MOSFET and design of amplifier circuits. DC behavior of Bipolar-Junction transistors (BJT) and their application in circuits. AC application of BJT and design of amplifier circuits. Basics of multistage amplification. (Spring) Prerequisite: EG2321.

EG 2343. Statics. 3 Semester Hours.
Fundamentals of statics, vector methods, concentrated and distributed force systems, methods of moments for extended rigid structures, statice quilibrium of structures. Topics also include Moments of inertia, Friction, and Centroids/Center of Gravity. (Fall; Spring) Prerequisites: EG1341, MT2412, and PY1404.

EG 2344. Dynamics. 3 Semester Hours.
This course covers the kinematics and kinetics of particles and rigid bodies in two and three dimensions. Topics include linear and angular motion, Newton’s laws of dynamic equilibrium (force and acceleration), work and energy principles, and impulse and momentum principles. Additional topics include dynamic friction effects and an introduction to mechanical vibrations. (Spring) Prerequisites: EG2343 and MT2413.

EG 2346. Strength of Materials. 3 Semester Hours.
This course covers the mechanical behavior of materials and structures under various loading conditions. Topics include stress, strain and stress-strain relations, as well as normal and torsional stresses in axially loaded members, bending and shear stresses in beams, combined stresses, and stress transformations. Additional topics include buckling in columns, deflection in beams, and material failure theories. (Spring) Prerequisites: EG2343 and MT2413.

EG 2354. Systems Eng. and Management. 3 Semester Hours.
Introduction to Engineering Management, planning, organizing, allocating resources, directing, controlling, skills, role of practicing engineering managers and future challenges. Introduction to Systems Engineering, systems life-cycle process, systems engineering method: process inputs, requirements analysis, functional analysis and allocation, synthesis, process tools, and process outputs. Overview of implementation, especially, testing and validation. (Spring) Prerequisite: none.

EG 2360. Unix Operating System & Python Programming Language. 3 Semester Hours.
This course focuses on UNIX operating System and Python Programming Language. Majority of the drone systems today use Unix/Linux operating system as their software platform. Hence, a good knowledge of this operating system is essential for drone designers, maintainers, and operators. Furthermore, Python is becoming the language of choice for certain aspects of software development, which makes it a necessary tool to be familiar with.

EG 2372. Linux Operating Sys and Python. 3 Semester Hours.
Introduction to operating system; Types of LINUX OS; The Kernel; The Shell; Files & Processes; The Directory Structure; LINUX System Utilities and commands. Python basics: strings; numbers; Booleans; conditional statements; functions; sets; lists; dictionaries; tuples; classes and objects; and important libraries. (Spring) Prerequisite: EG1316.

EG 2391. Industrial Automation and Cont. 3 Semester Hours.
Logic-structured and icon-driven programming. Introduction to industrial field devices for control and automation. Number systems and codes. Digital and analogue signals. Interposing relay control. Timers, counters, and data compare instructions. In-class labs and design projects are required. (Spring)Prerequisites: EG1294 and EG1194 or EG1213 and EG1113.

EG 2393. Engineering Economy. 3 Semester Hours.
This course introduces students to concepts and methods of economy, finance, and accounting in the context of engineering as an economic activity within a globally-connected society. Students will explore the changing value of money and goods over time through the effects of interest, inflation, and currency exchange, and apply this knowledge to analyze the breakeven and payback of engineering projects and engineered products, as well as to compare alternatives. Capital and operating costs, sustaining capital for replacements and overhauls, and salvage value and remediation or recycling cost will figure into our analyses. As tools for project management, students will gain exposure to financial statements and their notation, the stage-gate process for financing projects as stakeholder investments, the value of earned work hours, the escalation and scaling of estimates, and how to quantify risk in dollars. The course teaches spreadsheet skills and makes extensive use of Excel. (Fall; Spring; Summer) Prerequisite: none.

EG 2421. Circuit Analysis I. 4 Semester Hours.
This course familiarizes students with fundamental concepts of electricity and magnetism needed for circuit design and analyses; basic circuit elements and models; resistive circuits; circuit theorems; loop and nodal analysis of resistive networks; techniques of analysis of operational amplifiers; analysis of circuits with energy storage elements (capacitors and inductors); natural and step response of RL; RC; and RLC circuits. (Fall) Corequisite: MT2332(either a prerequisite or a corequisite). Prerequisite: PY1404.

EG 2423. Circuits & Systems. 4 Semester Hours.
An introduction to the fundamentals of electricity and magnetism needed for design and analyses of basic electric circuits; theory and applications of electrical circuits, devices, and systems; review of basic physics involving resistors, inductors, and capacitors; electrical units and measurements; analysis of dc circuits; analysis of the transient response to RL and RC switching circuits; introduction to ac circuit analysis; the frequency response; diodes, rectifiers, and wave#shaping circuits; applications of operational amplifiers.(Fall; Spring) Prerequisites: MT2413.

EG 3101. Engineering Design & Analysis Workshop I. 1 Semester Hour.
Students learn the foundation skills, concepts, structure, and application of engineering design by working individually and in teams on a variety of design related activities and projects. The course activities require students to identify opportunities, develop requirements, perform analysis/synthesis, generate multiple solutions, evaluate them against requirements, and make trade-offs by applying appropriate math, basic science or engineering, involve (iterative and creative) decision-making process for devising a system, component or a process to meet desired needs by considering technical constraints, risks, public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors (such as accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards/codes, sustainability, or usability), design thinking, design sprints, usability for product/process development. (Fall) Prerequisite: EG1303.

EG 3102. Engineering Design & Analysis Workshop II. 1 Semester Hour.
The course emphasizes team projects, with each student contributing uniquely based on their background. Students will develop essential teamwork skills, demonstrate leadership, and recognize and promote diversity and inclusiveness by incorporating varied perspectives, ideas, skills, and backgrounds. Effective project management is a key focus, including setting goals, planning tasks, and meeting objectives using tools such as Gantt charts, schedules, Scrum methodology, goal setting, and decision matrices. The course also fosters innovation and entrepreneurship. A term design project is a central feature, requiring students to demonstrate commitment to on-time delivery and effective teamwork. (Spring) Prerequisites: None.

EG 3112. Digital System Design Laboratory. 1 Semester Hour.
Experiments illustrate the principles learned in the Digital Systems Design (EG 2382) class. The first part of this laboratory focuses on the design of sequential networks using 7400 series TTL and CMOS devices. This includes comparing the electric characteristics; drive capability, fan-in, and fan-out of TTL and CMOS devices; Tristate buffers, and Open-collector outputs. The second part of this laboratory emphasizes the more recent digital systems design techniques that use modern CAD tools that support Hardware Design Languages such as VHDL. Many laboratory experiments introduce students to various VHDL sequential and concurrent constructs. Students learn how to simulate, verify, and synthesize their designs using state-of-the-art CAD tools. Writing intensive course. (Spring) Prerequisite: EG2113; Corequisite: EG3212.

EG 3121. Electronics II Laboratory. 1 Semester Hour.
Biasing Transistor good and bad; Input/output impedance of a device; Current source and current mirror; Push-pull; Op-amp limitations; Switching at higher frequencies; Analog switches; Chopper circuit, sample-and-hold, and negative supply from positive; Switched capacitor filters; Differential amplifiers, Miller Effect, Darlington pair, and bootstrap; Comparators and Schmitt triggers; RC Oscillators and Wein bridge; A/D and D/A conversions; Voltage regulators; Phase-locked loop circuit; the frequency multiplier. (Fall) Prerequisite: EG2126; Corequisite: EG3321.

EG 3122. Advanced Electronics Design Lab. 1 Semester Hour.
This hands-on laboratory course emphasizes the design, construction, and testing of advanced analog, digital, and mixed-signal electronic circuits. Students will work on practical projects involving operational amplifier circuits and feedback mechanisms, active filters, oscillators, voltage regulators, and both linear and switching power supplies. Additional focus areas include precision and low-noise design techniques, instrumentation amplifiers, and the implementation of analog-to-digital (ADC) and digital-to-analog (DAC) converters. Students will gain experience evaluating frequency response, analyzing circuit performance, and troubleshooting complex systems. MultiSIM is heavily used throughout the lab to simulate and validate circuit designs prior to physical implementation. (Spring) Corequisite: EG 3322.

EG 3126. Adv Electronics Design Lab. 1 Semester Hour.
This course includes individual design, construction and testing of analog, digital, and mixed electronics subsystems. Typical exercises include power control, oscillators, instrumentation amplifiers and applications, digital and mixed systems, communications circuits, and electromechanical control systems. (Spring) Prerequisite: EG3121; Corequisite: EG3226.

EG 3141. Materials Laboratory. 1 Semester Hour.
This laboratory course provides hands-on experience in testing and analyzing the mechanical, physical, and thermal properties of engineering materials. Experiments include tensile, compression, hardness, impact, fatigue, and creep testing, as well as material microstructure characterization techniques. Additional experiments explore the effects of mechanical and heat treatment processes on microstructure and mechanical properties. Emphasis is placed on understanding the relationship between mechanical material properties, failure mechanisms, material microstructure, and material processing conditions. Lab safety practices, data collection, technical report writing, and teamwork are integral components of the course. (Fall) Prerequisite: EG2346; Corequisite: EG3341.

EG 3142. Thermodynamics & Fluids Lab. 1 Semester Hour.
This laboratory introduces the basic experimental techniques used to analyze, characterize, and design thermal-fluid systems. Students will learn techniques for measurement of fluid and thermal properties of solids, liquids, and gases. Topics include the measurement of transport phenomena, calibration of sensors, reference standards, and design of experiments. (Spring) Corequisite: EG4342.

EG 3164. Human Computer Interaction Lab. 1 Semester Hour.
This course teaches the principles of and research methods in human-computer interaction (HCI) through a series of hands-on sessions and experiments. Students in the HCI lab will design, implement, and evaluate systems that are user centered. Additionally, students learn how to design user studies, apply standard HCI methodologies and research tools to understand human perception and cognition and evaluate the interaction between users and computer systems. (Spring) Corequisite: EG3264.

EG 3172. Remote Pilot Operations. 1 Semester Hour.
This course trains students in proper pilot operation of drones as well as general operational rules and etiquettes. This includes an examination and analysis of their integration with commercial and military airspace, regulations, weather, chart use, safety, air traffic control, and civilian/federal air and ground operations. Students will be required to pass the Unmanned Aircraft General Exam. (Fall) Prerequisite: EG2121; Corequisite: EG3371.

EG 3191. Data Visualization and Analytics Laboratory. 1 Semester Hour.
Hands-on sessions on data visualization, data collection/acquisition, organization, clean-up, developing relationships, designing queries, application of descriptive, prescriptive, or predictive analytics methods, building relevant charts/plots, designing dashboards and visual stories for solving supply chain or service systems problems using MS Excel, PowerBI, Tableau, Alteryx, or other relevant analytics software applications. (Fall) Prerequisite: EG1194; Corequisite: EG3391.

EG 3192. Simulation Laboratory. 1 Semester Hour.
Hands-on sessions for developing discrete-event system simulation models using model elements such as locations, entities, arrivals, processing and routing, attributes, user-defined variables, functions and macros, calendar/shifts in addition to collection and analysis of data, curve fitting, output analysis and hypothesis testing for comparison of alternative systems for solving supply chain or service systems problems using relevant simulation application such as ProModel. (Spring) Corequisite: EG3396.

EG 3196. Human Factors, Ergonomics and Safety Laboratory. 1 Semester Hour.
Students in the HFES Lab are trained in practical applications and research by participating in hands-on sessions and experiments to explore principles, standards, and technologies that make work more efficient, accessible, enjoyable, and safer. (Spring) Corequisite: EG3296.

EG 3212. Digital Systems Designs. 2 Semester Hours.
Review of sequential network design concepts; iterative networks; integrated circuit logic families and their electric characteristics; Mixing logic families; Hazard detection and prevention; designing digital systems using Programmable Logic Devices (PLD); digital systems design using Algorithmic State Machine (ASM) charts. Design of combinational and sequential networks using VHDL. Students will learn how to use the top-down design techniques to analyze, design, simulate, verify, and synthesize complex digital circuits using modern CAD tools. (Spring) Prerequisites: EG2113 and EG2313.

EG 3226. Advanced Electronics Design. 2 Semester Hours.
Advanced Electronic Design is a practical design course at the integrated circuit level. The topics include operational amplifier circuitry and feedback, active filters, oscillators, voltage regulators, linear and switching power supplies, precision and low noise techniques, and digital circuitry. (Spring)Prerequisite: EG3321.

EG 3264. Human Computer Interaction. 2 Semester Hours.
The goal of this course is to teach the fundamentals of human-computer interface in software design and development. Students learn to design, implement, and evaluate effective and usable graphical computer interfaces. The course emphasizes the importance of usability and iterative design. Design of windows, menus, and commands. Voice and natural language I/O. Response time and feedback. Color, icons, and sound. Students work on individual and team projects to design, implement, and evaluate computer interfaces. (Spring) Prerequisite: EG1316.

EG 3312. Digital Systems Design. 3 Semester Hours.
Review of sequential network design concepts; iterative networks; integrated circuit logic families and their electric characteristics; Mixing logic families; Hazard detection and prevention; designing digital systems using Programmable Logic Devices (PLD); digital systems design using Algorithmic State Machine (ASM) charts. Design of combinational and sequential networks using VHDL. Students will learn how to use the top-down design techniques to analyze, design, simulate, verify, and synthesize complex digital circuits using modern CAD tools. (Spring) Prerequisites: EG2113 and EG2313.

EG 3313. Computer Organization and Architecture. 3 Semester Hours.
This course explores the fundamental principles of Computer Organization and Architecture, with a strong emphasis on RISC (Reduced Instruction Set Computer) architecture. Topics include instruction set architecture (ISA), addressing modes, and instruction formats. Students will examine the design and operation of the Arithmetic Logic Unit (ALU), data paths, and control. The course also introduces CPU performance evaluation techniques and delves into pipelining, including pipelined data paths, control, and hazard handling. Additionally, students will study the memory hierarchy, covering cache fundamentals, cache performance optimization, and virtual memory principles. Through practical exercises and hands-on projects, students will gain a deep understanding of modern processor design, with a particular focus on RISC-based architectures. (Fall) Prerequisite: EG2313.

EG 3316. Human Factors. 3 Semester Hours.
Integration of the human component into the design, development, and evaluation of human-machine systems. Ergonomic and human factors research methodology. A term project featuring the design of a human-machine system from an ergonomic/human factors perspective is required. (Spring only) Pre-requisite: none.

EG 3321. Electronics II. 3 Semester Hours.
The second part of a two-semester course sequence, which focuses on analog electronic circuits. Differential and multi-stage amplifiers; feedback in amplifier circuits; frequency response of different amplifiers; the four basic feedback topologies in amplifiers; various output stages; power amplifiers; and the complete analysis of the 741 operational amplifier circuit. (Fall) Prerequisites: EG2326 and EG2324.

EG 3322. Advanced Electronics Design. 3 Semester Hours.
This course emphasizes practical circuit design and analysis. Key topics include operational amplifier circuits and feedback mechanisms, active and passive filters, oscillators, voltage regulators, linear and switching power supplies, precision and low-noise design techniques, AM and FM modulation, analog to digital and digital to analog circuits, and frequency response. multiSIM will be heavily used throughout the course for simulation and design validation. (Spring) Prerequisite: EG 2326: Electronics.

EG 3323. Microprocessors I. 3 Semester Hours.
This is the first part of a two-semester course sequence that is intended to familiarize students with the development of microcontroller-based products. The first goal of the course is to teach students the skills of assembly language programming in general and mixed programming with C. The second goal of the course is to introduce and familiarize students with different architecture and hardware designs in microcontrollers. (Fall) Prerequisites: EG1113 and EG1213.

EG 3324. Microprocessors II. 3 Semester Hours.
The second part of a two-semester course sequence is intended to familiarize students with the development of microcontroller-based products. Concepts covered in this course include interfacing, timing diagrams and synchronization for handshake purposes. The course utilizes all the onboard functionalities microcontroller such as the A/D converter; synchronous and asynchronous serial interfaces; a timer module with input capture, output compare, and pulse accumulator capabilities; PWM; controller area network (CAN); and a variety of input and output ports. (Spring) Prerequisite: EG3323 and EG 2313.

EG 3325. Signals and Systems. 3 Semester Hours.
Mathematical modeling and properties of continuous signals. Mathematical modeling and properties of linear systems, time-invariant systems, Bounded-Input-Bounded-Output (BIBO) stable systems. Basics of Fourier Series and Fourier Transform. Response of continuous Linear-Time-Invariant (LTI) systems to periodic and non-periodic signals. The convolution integral. Analysis of Power spectrum of periodic signals and energy spectrum of non-periodic signals. Sampling theorem. (Fall) Prerequisites: EG1122, EG2324, and MT2333.

EG 3326. Electromagnetic Theory. 3 Semester Hours.
Basics of transmission lines, including signal propagation, line impedance, impedance matching and power analysis. Review of the electric and magnetic fields. Maxwell’s Equations and its application to design and analysis of waveguides and antennas. (Spring) Prerequisites: EG2324 and MT2333.

EG 3328. Control Systems. 3 Semester Hours.
This course provides a comprehensive introduction to automatic control systems, covering both theoretical analysis and practical design for various engineering applications. Key topics include the modeling of physical systems using transfer functions and state-space representations, system response analysis, and performance evaluation based on design criteria. The course explores control system characteristics such as stability, sensitivity, steady-state errors, and transient response. Students will learn stability analysis techniques, including the Routh-Hurwitz criterion, Root Locus, Nyquist, and Bode methods. The course also covers lead and lag compensators, PID controllers, and control system design using the Root Locus and frequency response methods. MATLAB and SIMULINK are integrated throughout to facilitate system analysis and design. (Spring) Prerequisite: EG3325.

EG 3341. Materials Engineering. 3 Semester Hours.
This course introduces the fundamental principles of materials engineering, with a particular focus on the structure-property relationships of metals, polymers, ceramics, and composites. Topics include atomic and crystal structures, imperfections in solids, mechanical properties of metals, diffusion, dislocation and strengthening mechanisms, failure mechanisms (e.g., fracture, fatigue and creep), phase diagrams and phase transformations, and corrosion and degradation of metals. The effects of heat treatment, alloying, and material processing on material microstructure and mechanical properties are also explored. (Fall) Prerequisites: CH1401 and MT2412.

EG 3342. Engineering Thermodynamics I. 3 Semester Hours.
This course introduces students to thermodynamics from an engineering perspective. Topics covered include thermodynamic properties, the first and second laws of thermodynamics, ideal and real gases, analysis of closed and open systems, entropy, reversibility, and practical thermodynamic cycles. (Fall) Prerequisites: MT2413 and CH1401.

EG 3343. Fluid Mechanics. 3 Semester Hours.
This course covers the theory and analysis of forces and motion in liquids and gases at rest and in motion. The fundamental laws of fluid behavior (conservation of mass, energy, and momentum) are introduced and applied. Fluid systems are analyzed using differential and finite control volume approaches for steady, incompressible flow. The effects of viscosity are studied for internal and external flow. (Fall) Prerequisites: EG2343, and MT2332.

EG 3344. Power Systems. 3 Semester Hours.
This course covers the use of renewable and non-renewable energy sources in power production. Energy conversion processes are analyzed, and performance characteristics of components and systems are modeled using modern computational methods. Engine component matching for design using analysis routines, including centrifugal and axial flow turbines and compressors, inlets, diffusers, nozzles, fans, and propellers. Applications may also include design of nuclear, solar, wind, wave, thermoelectric, and geothermal energy systems. (Elective) Prerequisites: EG3342 and EG3343.

EG 3346. Dynamics and Controls. 3 Semester Hours.
This course provides a comprehensive introduction to the theory, design, and analysis of dynamic control systems. Topics include modeling dynamic system responses and designing control systems. Students will explore transient and steady-state response analysis across various systems, including mechanical, electrical, electromechanical, and thermal-fluid systems. The course covers first- and second-order linear systems, sources of nonlinearity, feedback principles, and classical control theory. Key concepts such as transfer functions, time and frequency response, vibration, damping, and automatic control systems are examined in depth. Additionally, hands-on laboratory experimentation includes measurement and instrumentation, sensor calibration, transducers, data acquisition, and control system design. (Spring) Prerequisites: EG2344, EG1341, EG2323, and MT2333.

EG 3347. Mechanical Design I. 3 Semester Hours.
Failure theories, fatigue, and thermal/environmental considerations in the design process. Design of machine elements, fasteners and weldments, pressure vessels, and robotic elements. Methods for the calculation of deflection of machine components. (Fall) Prerequisites: EG2346 and EG2344; Corequisites: EG3349.

EG 3348. Mechanical Design II. 3 Semester Hours.
This course offers an integrated viewpoint of mechanical design with lectures on special topics. Concepts in design optimization and computer simulation are considered in the design and synthesis of mechanical engineering systems. The design projects are comprehensive, emphasizing creative design, and requiring design decisions to build a final prototype. (Spring) Prerequisites: EG3347, and EG3349.

EG 3349. Computational Methods for Engineering. 3 Semester Hours.
Introduction to numerical methods with emphasis on algorithm construction, analysis, and implementation to provide solutions to common problems formulated in science and engineering. Programming, round-off error, root finding for nonlinear equations, solutions of equations in one variable, interpolation and polynomial approximation, approximation theory, direct solvers for linear systems, numerical differentiation and integration, initial-value problems for ordinary differential equations and boundary value problems. Observe firsthand the issues of accuracy, computational work effort, and stability. (Fall) Prerequisites: EG1294, EG2346, and MT2332.

EG 3353. Engineering Project Management. 3 Semester Hours.
The course introduces knowledge and skills required for project management, including communication, cost management, estimating, earned value, planning & scheduling, and risk management. Students will explore the role of project managers within the matrix structure of an engineering enterprise, and understand how individual projects fit into a company's portfolio of work, where clients and projects may come and go. Students will read requests for proposals, write proposals, and learn how to decide whether to bid or not. Students will apply project management process assets: artifacts such as the scope, budget, project charter / opener, risk register, quality management plan, work breakdown structure (WBS), schedule, Gantt chart, and network diagram; methods such as benchmarking, earned value management (EVM), estimating, forecasting, and SWOT; and models such as Cynefin. Student teams will engage with cases based on real public filings from the licensing and permitting of complex, interdisciplinary engineering projects. Teams will develop and present a comms plan, cost estimate and analysis, engineering risk matrix, construction risk matrix, execution plan, and schedule. (Fall) Prerequisite: none.

EG 3360. Requirements Engineering. 3 Semester Hours.
This course introduces the fundamentals of software requirements management. Topics covered include requirements gathering, system modeling and software specifications. The major emphasis is on using a variety of modeling tools and techniques to define a system specification. Languages and models for representing requirements. Analysis and validation techniques, including need, goal, and use case analysis. Students participate in a group project on software requirements. (Spring) Prerequisite: EG3365.

EG 3361. Software Project Management. 3 Semester Hours.
This course introduces concepts deemed central to effective management of software projects. Software systems engineering, process management and control, and project planning and management. Using specifications and descriptions, making use of structured and object-oriented techniques, completing reviews and audits, confirming product development with planned verifications, and validations and testing. Management of expectations. Release and configuration management. Software process standards and process implementation. Software contracts and intellectual property. (Fall) Prerequisite or Corequisite: EG 3365.

EG 3362. Software Design and Architecture. 3 Semester Hours.
This course explores fundamental principles and practices of software design and architecture. Students learn architectural patterns (microservices, event-driven, serverless, layered), design patterns (GoF patterns, SOLID principles), and architectural styles (REST, MVC, hexagonal). Core topics include middleware architectures, component-based design, and frameworks. The course emphasizes designing for quality attributes: performance optimization, security by design, scalability, reliability, maintainability, and reusability. Students apply techniques for architectural modeling (UML, C4 model), technical decision-making, and trade-off analysis. Through hands-on projects, students evaluate architectures using metrics and architectural fitness functions. Topics include cloud-native architectures, API design, domain-driven design, and architectural documentation. Students develop skills in building, documenting, and assessing software architectures for modern distributed systems. (Spring) Prerequisite: EG 1316 and EG 2312.

EG 3365. Software Engineering. 3 Semester Hours.
This course provides comprehensive training in software engineering principles and modern development practices. Students learn Agile methodologies (Scrum, Kanban), requirements engineering, software architecture, and design patterns. Core topics include object-oriented analysis/design using UML, cloud-based software development, and version control systems. Students gain hands-on experience with software testing strategies (unit, integration, system testing), quality assurance practices, and security/privacy considerations. Project management principles include sprint planning, user story mapping, and stakeholder communication. The course introduces DevOps concepts and CI/CD fundamentals. Students work in teams to develop applications using industry-standard tools, applying best practices for code management, testing, and documentation to create secure, maintainable software solutions. (Fall) Prerequisite: EG2312.

EG 3367. Java and Applications. 3 Semester Hours.
Introduction to Java applications. Control structures and arrays in Java. Object-oriented programming principles: Encapsulation, abstraction, inheritance, and polymorphism. Objects and classes. Unified modeling language (UML). Strings and text manipulation. Exception handling. Graphics and Java2D. Graphical User Interface (GUI) components. Layout managers. Event-driven connection (JDBC). Extensive use of Java programming. (Fall only) Prerequisites: EG 1213 or CS 1310, and EG 1316. (All courses serving as prerequisites in the School of Science, Engineering, and Technology must be completed with a C or better in order to advance to the next sequenced course.).

EG 3369. Human Computer Interaction. 3 Semester Hours.
The goal of this course is to teach the fundamentals of human-computer interface in software design and development. Students learn to design, implement, and evaluate effective and usable graphical computer interfaces. The course emphasizes the importance of usability and iterative design. Design of windows, menus, and commands. Voice and natural language I/O. Response time and feedback. Color, icons, and sound. Students work on individual and team projects to design, implement, and evaluate computer interfaces. (Spring) Prerequisite: EG1316.

EG 3371. Unmanned Aircraft Systems I. 3 Semester Hours.
This course is an introductory survey and development of an Unmanned Aerial Systems (UAS) and their role in the aviation industry, as well as an increased awareness of the importance of UAS in modern commercial and military operations. An analysis of UAS is covered, including structural and mechanical factors, avionics, navigation, flight controls, remote sensing, guidance control, and logistical support. The course will also look at past, current and future applications of UAS operations, with an emphasis on commercial applications. (Fall) Prerequisites: EG2372 and MT2332.

EG 3373. Unmanned Aerial System - Sensing Systems. 3 Semester Hours.
This course is an introductory survey and development of an Unmanned Aerial Systems (UAS) and their role in the aviation industry, as well as an increased awareness of the importance of UAS in modern commercial and military operations. An analysis of UAS is covered, including structural and mechanical factors, avionics, navigation, flight controls, remote sensing, guidance control, and logistical support. The course will also look at past, current and future applications of UAS operations, with an emphasis on commercial applications. (Fall) Prerequisites: EG2372 and MT2332.

EG 3376. Unmanned Aircraft Systems II. 3 Semester Hours.
This course provides an overview of the technology and concepts used to remotely gather information to satisfy task requirements as well as to gain understanding about an unmanned system's operating environment. Students will examine the fundamental concepts and methods of sensing systems including the type, format, and capabilities of sensors; component and system integration; use cases; challenges and issues; and emerging concepts. Attention will be given to tools and methods used to support development, configuration, and application of sensing systems. Students will develop experience through complex mission planning assignments and guided discussion. (Spring) Corequisite: EG3376.

EG 3391. Data Analytics and Information Engineering. 3 Semester Hours.
Introduction to data analysis, setting a well-defined goal/objective, delineating constraints, structured data analysis plan, stakeholder agreement, analytics problem formulation, defining key metrics, identify data needs, data collection/acquisition, harmonize, rescale, and clean data, data mapping/ relationships, pivot, unpivot, slicers, and SQL queries. Introduction to visualization using a relevant software application. Formatting and exporting graphs, rows/column shelves, mark card, identifying outliers, analysis using filter and group, date hierarchy. Using charts, plots, calculations, data blending and parameters. Analytical model building, validation, testing, solution deployment, model life-cycle management. Reporting using dashboards. Visual story design. Visualization tools, Hourglass model, story elements, storyboarding, testing, fallacies due to over generalization, misinterpretation, and correlation as opposed to causation. Introduction to machine learning, artificial intelligence, and big-data analytics. (Fall) Prerequisite: EG1294; Corequisite: EG3395.

EG 3392. Human Factors, Ergonomics and Safety. 3 Semester Hours.
Integration of the human component into the design, development, and evaluation of human-machine systems. Ergonomic and human factors research methodology. Applied Anthropometry. Introduction to Safety Engineering. The OSHA Act and the costs of Accidents in the workplace. Safety Engineer's role in plant Safety and specific programs. A term project featuring the design of a human-machine system from an ergonomic/human factors perspective is required. (Spring) Prerequisite: none.

EG 3394. Lean Production Systems. 3 Semester Hours.
Principles, models and techniques for production planning and analysis of production systems. Demand forecasting. Capacity planning. Aggregate planning. Master production scheduling. Demand management. Deterministic and stochastic inventory lot-sizing. Material requirements planning. Scheduling. Assembly line balancing. Lean and just-in-time principles. Material handling. Analytical principles of production systems design, analysis, and control with emphasis on stochastic analysis. Role of variability and impact on cycle time. Push versus pull production strategies including Kanban and constant WIP control. Little's Law. (Spring) Prerequisite: EG3395.

EG 3395. Industrial Statistics and Design of Experiments. 3 Semester Hours.
This course covers topics in engineering statistics including descriptive statistics, probability and probability distributions, statistical tests, and confidence intervals for one and two samples, regression models, designing and analyzing engineering experiments. The focus is on the application of statistics to a variety of problems in the context of engineering and management decisions. (Fall; Spring; Summer) Prerequisite: MT2413.

EG 3396. Simulation. 3 Semester Hours.
Discrete-event Monte Carlo simulation. Statistical data collection. Simulation modeling: model building, verification, and validation using simulation software. Output analysis. (Spring) Prerequisite: EG3395.

EG 3398. Six Sigma Quality. 3 Semester Hours.
Statistical process control: The DMAIC process. Data collection and analysis, statistical process control, process capability. Introduction to Six-Sigma Certification. Failure mode and effect analysis. Benchmarking. Value stream mapping. Quality function deployment. Kaizen. Relationship between Lean and Six Sigma Lean. (Spring) Prerequisite: EG3395.

EG 4101. Eng. Design & Analysis Workshop III. 1 Semester Hour.
Course activities involve application of professional and ethical concepts from the National Society of Professional Engineers (NSPE) Code of Ethics for Engineers and ethical frameworks such as utilitarianism and virtue theory for ethical decision making. Course activities require students to identify ethical/professional issues, perform systematic analysis, and make informed judgments based on the impact of product/process design or engineering solutions in global, economic, environmental, and societal contexts. Course activities require students to independently identify and apply new knowledge through reference to external resources such as engineering standards and research publications. (Fall) Prerequisites: PL2301.

EG 4102. Special Topics I. 1 Semester Hour.
Course may be repeated for credit if topics vary. (Elective).

EG 4103. Special Topics II. 1 Semester Hour.
Course may be repeated for credit if topics vary. (Elective).

EG 4104. Special Topics III. 1 Semester Hour.
Course may be repeated for credit if topics vary. (Elective).

EG 4122. Energy Conversion Laboratory. 1 Semester Hour.
Laboratory examination of the design, construction and operating characteristics of transformers and various types of motors and generators. Measurement of transformer parameters. The experimental investigation of the ac generator (alternator); the series, shunt, and compound dc motors; the synchronous motor; the induction motor; and the universal motor. This is a writing-intensive course. (Elective) Corequisite: EG4322.

EG 4138. Special Topics. 1 Semester Hour.

EG 4141. Measurements and Instrumentation Laboratory. 1 Semester Hour.
This course covers important measurement techniques and instruments used in mechanical engineering. Students will gain hands-on experience with various tools, sensors, transducers, signal conditioning and data acquisition systems for linear and angular measurements, surface roughness, and the measurement of physical quantities such as temperature, pressure, force, displacement, velocity, acceleration, and mechanical strains. Experiments cover the calibration, operation, and analysis of measurement systems, along with the evaluation of measurement errors and uncertainty propagation. The course also emphasizes understanding instrumentation principles, developing experimental setups, executing measurements with high accuracy and precision, and interpreting experimental data. (Fall) Prerequisites: EG3141, EG3142, EG2123, and EG1341, EG3346.

EG 4152. Engineering Leadership Workshop. 1 Semester Hour.
Workshop sessions focusing on creating visions and courses of action, making decisions factoring in risk, accomplishing a mission in the face of constraints or obstacles, committing to on-time delivery and pursuing necessary follow-up, adhering to ethical standards and principles, instilling trust and loyalty in a team, facing difficult/high-risk actions, identifying new products, systems, processes and methods for invention, innovation and implementation, exercising judgment and critical reasoning, listening to others, recognizing others' strengths, mentoring, communicating and advocating, connecting across disciplines, skills and cultures, negotiating and compromising to find mutually acceptable solutions. (Fall) Corequisite: EG4252.

EG 4191. Manufacturing Processes Laboratory. 1 Semester Hour.
Laboratory exercises and experimentations in manufacturing processes. Measurement and optimal process parameter selection in metal machining, welding, metal forming, casting and plastic processing, Material selection, design and fabrication of parts and assemblies using design for manufacturability (DFMA) techniques. Use of standards related to size, shape material, input, and output parameters in manufacturing. (Fall)Corequisite: EG4291.

EG 4192. Computer Aided Manufacturing and Robotics Laboratory. 1 Semester Hour.
Operations and programming of stepper and servomotors; integration of discrete-event sensors with microcomputer interfaces. Programming, simulation, implementation, and applications of industrial robots and microcontrollers. Experiments on computer numerical control (CNC) programming and coordinate measuring machines (CMM). Solid modeling on CAD. Weekly written reports on experiments are required. (Spring) Corequisite:EG4392.

EG 4193. Optimization and Decision Analytics Lab. 1 Semester Hour.
Laboratory sessions for solving operations research problems pertaining to linear programming, network programming, dynamic programming, non-linear programming, mixed integer programming, stochastic programming characterized by large-scale instances, multiple objectives, realistic constraints using operations research software applications such as CPLEX or Gurobi solvers. Emphasis will be placed on model formulations, programming in an appropriate language, solving using a relevant software application, interpretation, and analysis of results, setting termination and run-time parameters, selection of appropriate solution techniques, optimality gaps and model life-cycle management. (Fall) Prerequisite: EG3191; Corequisite: EG4393.

EG 4194. Smart Manufacturing Laboratory. 1 Semester Hour.
Application of smart manufacturing processes to optimize manufacturing systems. Programming, simulation, and implementation of industrial robots and sensors for data collection. Advanced manufacturing processes common in Industry 4.0 will also be discussed. Weekly written reports on experiments are required. Corequisite: EG4394.

EG 4196. Supply Chain and Logistics Engineering Laboratory. 1 Semester Hour.
Laboratory sessions for solving problems pertaining to forecasting, multi-echelon inventory, supplier selection, customer stratification, warehouse layout design, logistics network design, vehicle routing, reverse logistics management, supply contract design for channel coordination, and pricing/revenue management characterized by large-scale data, realistic constraints, competing objectives, uncertainty and risk using relevant methods and software applications. (Spring) Prerequisite: EG3191; Corequisite: EG4396.

EG 4202. Special Topics. 2 Semester Hours.

EG 4203. Special Topics. 2 Semester Hours.

EG 4204. Special Topics. 2 Semester Hours.

EG 4238. Special Topics. 2 Semester Hours.

EG 4252. Engineering Leadership. 2 Semester Hours.
The course introduces the concepts, theory, and practice of engineering leadership with effective written and oral communications and presentations. Topics include engineering leadership characteristics, Covey approach, Kouzes and Posner transformational leadership approach, proactive leadership, succession planning, individual differences, and self-awareness, developing and building teams, managing knowledge workers, change, conflicts, and crises, and understanding ethics and core values. (Fall) Prerequisite: none.

EG 4291. Manufacturing Processes. 3 Semester Hours.
An overview of modern manufacturing process driven activities. Processing methods: casting, injection molding, assembling, machining, etc. Concepts related to synergize manufacturability, assemblability, reproducibility, and repeatability, interdependently, to achieve goals of value-added manufacturing processes. Experiments on computer integrated design, manufacturing related to specific manufacturing processes are conducted. (Fall) Prerequisites:EG3341 and EG1341.

EG 4301. Senior Design Project I. 3 Semester Hours.
This is the first course in the six-hour senior design sequence. It requires a thorough understanding and implementation of the iterative engineering design and analysis process: need recognition, literature review, assessment of societal impact, project management, definition of design objectives, design, model building, analysis, implementation, validation, and testing. Industry-university cooperation, status briefings with the industrial sponsors and senior design instructor are required. A common reflection theme is the impact of the students' engineering projects on the local, national, or global communities as they enter the next stage of their lives. (Fall) Prerequisite: Senior standing in the major and consent of the academic advisor. Co-requisite: EG 4101. Specific prerequisites by major: CE: Senior Standing; EE: EG 3321, EG 3324, and EG3226; EM: EG 3394, EG 3396, and EG 3398 ES: Advisor consent; IE: EG 3394, EG 3396, EG 3398, and Co-requisite EG4391; ME:,EG 3343, EG 2423, EG 3349, and EG 3348 SE: EG 3101, EG 3102, EG 3362, and EG 3365.

EG 4302. Senior Design Project II. 3 Semester Hours.
This is the second course in the six-hour senior design sequence. In addition to the requirements in EG 4301, this course requires a formal final presentation and comprehensive final report submission. The final report should include a reflection by each student about their personal growth in terms of their self-perception and maturity, spirituality, and their perception of others and the world as a result of their tenure at the university. This is a writing intensive course. (Spring) Prerequisite: EG4301.

EG 4303. Special Topics I. 3 Semester Hours.

EG 4304. Special Topics II. 3 Semester Hours.

EG 4305. Special Topics III. 3 Semester Hours.
Course may be repeated for credit if topics vary. (Elective).

EG 4306. Special Topics IV. 3 Semester Hours.
Course may be repeated for credit if topics vary. (Elective).

EG 4307. Special Topics Vi. 3 Semester Hours.
Course may be repeated for credit if topics vary. (Elective).

EG 4308. Special Topics VI. 3 Semester Hours.
Course may be repeated for credit if topics vary. (Elective).

EG 4309. Special Topics VII. 3 Semester Hours.
Course may be repeated for credit if topics vary. (Elective).

EG 4311. Linux Administration. 3 Semester Hours.
In this course, students will begin by learning how to install a Linux operating system on their own computers from scratch. Following this, the course provides in-depth coverage of Linux system configuration, monitoring, maintenance, common utilities and tools, and essential shell commands, enabling students to confidently administer a modern Linux server. Students will also develop skills in shell script programming within a Linux environment. Additionally, they will gain hands-on experience in setting up Linux servers such as Apache and OpenSSH. Upon completion, students will be well prepared for industry-standard Linux certifications, including the Linux Professional Institute Certification (LPIC-1) and CompTIA Linux+.

EG 4312. Data Sciences. 3 Semester Hours.
In this course, students will receive a comprehensive introduction to data science, covering key topics such as data collection, cleaning, exploration, and visualization. Students will learn the Python programming language and its practical applications in data science, gaining hands-on experience with real-world datasets. Through a series of projects, students will practice building predictive models, extracting insights, and effectively communicating their findings. By the end of the course, students will have a solid foundation in data analysis and data-driven decision-making, preparing them for careers in data science and analytics across a wide range of industries. Prerequisite: EG1294 or EG1213.

EG 4313. Machine Learning. 3 Semester Hours.
In this course, students will gain a solid foundation in machine learning, exploring fundamental concepts such as supervised and unsupervised learning, model evaluation, and algorithm selection. The course covers key techniques including regression, classification, clustering, and dimensionality reduction, with an emphasis on both theoretical understanding and practical application. Students will learn to implement machine learning algorithms using programming languages like Python, applying popular libraries such as scikit-learn and TensorFlow to real-world datasets. Through hands-on projects, students will develop the skills to build, train, and optimize machine learning models. By the end of the course, students will be prepared to tackle machine learning challenges across diverse industries and pursue further study or careers in machine learning and AI. Prerequisite: EG1294 or EG1213.

EG 4315. Cryptography Principles and Practices. 3 Semester Hours.
This course provides a comprehensive introduction to cryptographic principles and techniques. Topics include fundamental concepts of cryptography, symmetric encryption schemes, finite fields, number theory, and elliptic curves. Students will explore advanced cryptographic methods, including public-key cryptography, message authentication codes (MACs), hash functions, and digital signatures. The course also covers key management, secure key distribution, user authentication, and real-world applications of cryptographic protocols. Through theoretical foundations and practical applications, students will gain a strong understanding of modern cryptographic systems and their role in securing information. (Fall) Prerequisite: EG2312.

EG 4316. Computer Networks. 3 Semester Hours.
This course provides a foundational understanding of computer networking and data communication, structured around the OSI and TCP/IP reference models. Students will explore the roles and functions of each layer, including the application, transport, network, and link layers, as well as local area networks (LANs). The course also covers key design principles, performance metrics, and major challenges in building high-speed networks. Additionally, students will examine current trends and emerging technologies shaping modern computer networks. (Spring) Prerequisite: MT4331.

EG 4318. Parallel Programming. 3 Semester Hours.
Brief review of uniprocessor organization and architecture. Flynn taxonomy of parallel computers. Fundamental design issues in parallel processing. Interconnection networks, Parallelization process. Partitioning for performance. Data access and communication in a multi-memory system. Analysis of parallel algorithms. Performance issues from the processor perspective. Shared memory multiprocessors. Single level and multilevel cache hierarchies. Cache coherence issues, memory consistency, and synchronization. Snooping bus protocols. Distributed memory systems. Directory-based cache coherence. Parallel programming of distributed-memory systems using MPI. Parallel programming of shared-memory multi-core processors using Posix Threads (Pthreads) and OpenMP. (Spring) Prerequisites: EG3313 and EG2312.

EG 4322. Energy Conversion. 3 Semester Hours.
Three-phase circuits, magnetic circuits, transformers, electrical-mechanical transducers, dc motors, synchronous motors, induction motors, ac generators. Theoretical principles, mathematical models, operating characteristics, and practical applications of transformers, motors, and generators are emphasized. (Elective) Prerequisites: EG2324, EG3326, and MT2332.

EG 4323. Semiconductor Devices. 3 Semester Hours.
Review of quantum mechanics. Introduction to crystallography. Energy band and charge carriers in pure, n-type and p-type semiconductor materials. Physical properties of p-n junction and diodes. Physical behavior of Bipolar Junction Transistors (BJT) in active, saturation and cut off modes. Physical behavior of Field Effect Transistors (FET) in pinch off, triode and off modes. (Fall) Prerequisites: EG2326 and CH1401.

EG 4325. Digital Signal Processing. 3 Semester Hours.
Discrete time signals & systems, z-transform, discrete Fourier transform, flow graph and matrix representation of digital filters, digital filter design techniques and computation of the fast Fourier transform (FFT). MATLAB software package is heavily utilized in this course. (Fall) Prerequisite: EG3325.

EG 4328. Communication Theory. 3 Semester Hours.
Introduction to information theory. Review of Fourier Transform, Fourier Series and linear systems. Basics of digital communication systems, including conversion of analog signals into digital signals, digital signal transmission, wave shaping, companding, delta modulation, quantization noise and conversion of digital signals into analog signals. Basics of analog communication systems, including Amplitude Modulation (AM) and Frequency Modulation (FM). (Spring) Prerequisites: EG3325 and EG3395.

EG 4338. Special Topics I. 3 Semester Hours.

EG 4342. Heat Transfer. 3 Semester Hours.
This course introduces the fundamentals of heat transfer by conduction, convection, and radiation. The basic rate laws are coupled to the principle of conservation of energy for solid, fluid, and radiative systems. Topics covered include the concept of thermal resistance, analytical and numerical solutions of the heat equation, heat transfer from extended surfaces, boundary layers, convection correlations, and radiative exchange in diffuse, gray enclosures. The thermal analysis of realistic engineering systems is emphasize throughout. (Spring) Prerequisites: EG3342 and EG3343.

EG 4346. Engineering Thermodynamics II. 3 Semester Hours.
Thermodynamic principles applied to the analysis of power generation, refrigeration, and air-conditioning systems. Introduction to solar energy thermal processes, nuclear power plants, and direct energy conversion. (Elective) Prerequisite: EG3342.

EG 4348. Introduction to Biomechanical Engineering. 3 Semester Hours.
The course serves as an introduction to the fundamental science and engineering on which biomedical engineering is based. It covers applications of mechanical engineering principles to problems in the life sciences; transport phenomena of physiological solids and fluids; bio-signal analysis and instrumentation; bio-materials design and compatibility; principles of biomechanics and human locomotion; physiological systems modeling and control; case studies of drugs and medical products; illustrations of the product development-product testing cycle, patent protection, and FDA approval. (Elective) Prerequisites: EG3343, EG2346, and MT2332.

EG 4349. Aerospace and Wind Power Structures. 3 Semester Hours.
Design and analysis of flight structures and wind power structures. Topics from two- and three-dimensional elasticity. Behavior of composite materials. Stress and deflection analysis of thin-skinned stiffened structures. Introduction to the finite element method and its applicability in the design process. Manufacturing considerations. Course will include a design/build/test element. (Elective) Prerequisites: EG3341 and EG3347.

EG 4353. Innovation and Entrepreneurship. 3 Semester Hours.
The course introduces engineering students to the concepts and practices of innovation and entrepreneurial thinking. Using lectures, case studies, student projects, and student presentations, the course focuses on entrepreneurial thought and action that engineering students can utilize in supporting established organizations or startups. (Spring) Prerequisite: none.

EG 4361. Software Quality Assurance and Testing. 3 Semester Hours.
Testing and quality control of software projects. Testing methodologies: Unit testing, integration testing, test driven development, compatibility testing, web site testing, alpha, beta, and acceptance testing. Testing tools. Developing test plans. Managing the test process. Problem reporting, tracking, and analysis. Defects vs. failures. Quality: how to assure it and verify it, and the need for a culture of quality. Avoidance of errors and other quality problems. Inspections and reviews. Testing, verification, and validation techniques. Process assurance vs. Product assurance. Quality process standards. Product and process assurance. (Fall) Prerequisite: EG3362.

EG 4364. Software Maintenance and Evolution. 3 Semester Hours.
This course examines methodologies and practices for maintaining and evolving software systems in dynamic environments. Students learn techniques for analyzing, modifying, and modernizing legacy systems, including software re-engineering and data reverse engineering. Core topics include refactoring strategies, technical debt management, code quality metrics, and architectural transformation patterns. The course emphasizes designing maintainable software through modular design, clean code principles, documentation practices, and automated testing. Students explore strategies for incremental modernization, system migration (cloud transitions, containerization), and continuous evolution. Topics include change impact analysis, regression testing, version control strategies, and maintaining backward compatibility. Through hands-on projects, students apply tools for code analysis, documentation generation, and automated refactoring while developing skills in evaluating software for change and validating modifications in production environments (Spring) Prerequisite: EG3362.

EG 4366. Advanced Elec Design. 3 Semester Hours.
This course provides a comprehensive understanding of Agile methodologies for building cost-effective and high-quality systems. Students learn fundamental Agile concepts including Scrum framework, Kanban, product and sprint backlogs, and user-centered design through design thinking and design sprints. Core topics include requirements prioritization, project management using industry-standard tools (Jira), lean practices including Lean UX, and emerging DevOps practices. Students gain hands-on experience organizing and managing Agile projects, developing user-centered products, and applying Scrum and Kanban tools and techniques. The course emphasizes practical application through team-based projects where students model, design, implement, and test systems or applications in an Agile setting. Students work collaboratively to develop high-quality solutions while applying industry-standard Agile practices and tools. The course prepares students to effectively operate in Agile environments and manage projects using contemporary methodologies. (Spring) Prerequisites: None.

EG 4371. Introduction to Geographical Information System. 3 Semester Hours.
This course provides students with a solid foundation in both GIS concepts and the use of GIS. The course strikes a careful balance between GIS concepts and hands-on applications. The main portion of the course presents GIS terms and concepts and helps students learn how each one fits into a complete GIS system. Students will be presented with actual GIS exercises and the necessary data to solve the problem. (Fall) Prerequisite: EG3376.

EG 4372. Advanced Unmanned Aerial System Control, Navigation and Guidance. 3 Semester Hours.
The purpose of this course is to analyze the concepts of modeling, design, planning, and control of robotic systems. The student will evaluate robotics and control design decisions specific to unmanned systems, including remotely operated and autonomous unmanned aerial systems (UAS) and unmanned space systems. Course topics include robotics foundations in kinematics, dynamics, control, motion planning, trajectory generation, programming, telemetry, sensor integration, remote operation, and design. Course applications include task and motion planning for utilization within unmanned system technology. () Prerequisite: EG4371.

EG 4391. Manufacturing Processes. 3 Semester Hours.
An overview of modern manufacturing process-driven activities. Processing methods covered: casting, injection molding, assembling, machining, etc. Concepts related to synergize manufacturability, assemblability, reproducibility, and repeatability, interdependently, to achieve goals of value-added manufacturing processes are introduced. Experiments on computer integrated design and manufacturing related to specific manufacturing processes are conducted. (Fall) Prerequisites: Fall) Prerequisites: EG3341, EG1341.

EG 4392. Computer Aided Manufacturing and Robotics. 3 Semester Hours.
Modern manufacturing systems including automation, computer integrated manufacturing, robotics, and programmable logic controllers. Use of CAD/CAM/CAE software in analyzing industrial robots and manipulators. Design projects are required. (Spring) Prerequisites: EG4291 and EG2391.

EG 4393. Optimization. 3 Semester Hours.
Mathematical optimization model formulation. Classical optimization. Numerical search methods. Linear optimization via the graphical and simplex methods. Network flow optimization. (Fall) Prerequisite: MT2318 OR MT2332.

EG 4394. Smart Manufacturing. 3 Semester Hours.
An in-depth exploration of how advanced technologies and data-drive approaches are used to optimize and automate manufacturing processes. Topics include smart manufacturing processes, modeling and simulation of manufacturing systems, process control and monitoring, the Internet of Things, data collection and analysis, and process automation using industrial robots and CAD/CAM software tools. Prerequisites: EG1341.

EG 4395. Stochastic Modeling and Risk Analysis. 3 Semester Hours.
Introduction to stochastic modeling. Review of Probability Theory. Conditional probabilities. Conditional expectations. Markov chains, Chapman-Kolmogorov equations, and classification of states. Markovian decision process. Poisson process. Introduction to queuing systems. Birth-death processes. Queuing networks. Queuing decision models. Introduction to stochastic programming. Deterministic and stochastic dynamic programming. Introduction to enterprise risk management. An examination of the risks, controls, and assurance services. (Fall) Prerequisite: EG3395 OR MT4331 ORMT4332.

EG 4396. Supply Chain and Logistics Engineering. 3 Semester Hours.
Fundamental concepts and theory including the principles, models, and techniques for supply chain management planning, analysis, and design. Supply chain business processes, process metrics, and common, good, and best practices in supply chain management. Multi-echelon inventory models, channel coordination, supply contracts and negotiations, supply chain disruptions/risk management, pricing, logistics network design, vehicle routing, reverse logistics, closed-loop supply chains, glob-al manufacturing & distribution, supply chain profitability optimization. Decision making under un-certainties for optimal profitability in the context of global outsourcing, international logistics, and international trade treaties. (Spring) Prerequisites:EG3394 and EG3391.