Engineering

School

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

School Dean

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Department

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

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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/)

Academic Year: 2022-2023

Program	Enrollment	Graduates
Statistics		
Computer Engineering	18	2
Electrical Engineering	23	5
Industrial Engineering	18	6
Mechanical Engineering	62	8

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. (Fall; 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 of programming using Python and basic programming skills. The topics include Python control structures, variables, and basic data structures, organizing the code in functions and use of external libraries, recursion, basic search and sort algorithms, runtime error handling, File Input/Output, introduction to Object Oriented Programming and scientific calculations using NumPy. Labs also include assignments on introductory data and decision analytics using MS Excel. (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 1294. Python Programming for Eng. 2 Semester Hours.
The course includes applications of programming using Python and basic programming skills. The course topics include Python programming language, control structures, variables, and basic data structures, organizing the code in functions and use of external libraries, recursion, basic search and sort algorithms, runtime error handling, File Input/Output, introduction to Object Oriented Programming and scientific calculations using NumPy. Python programs are designed to solve problems in different fields of engineering. The course further introduces data and decision analytics for solving engineering problems. (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 majors. (Fall; Spring) Prerequisite: none.

EG 1316. Object-Oriented Prog and Des. 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 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.
Experimental verification of various circuit theorems and laws, understanding of the cathode ray oscilloscope functions; implementation and analysis of the transient response of first order and second order circuits; implementation and analysis of frequency response; resonant networks, series and parallel RLC circuits. Writing intensive course. (Fall) Corequisite: EG2421.

EG 2123. Circuits and Systems Lab. 1 Semester Hour.
Basis of electrical measurements and technical report writing. Experimental verification and applications of circuit theorems; investigation of the current divider, the voltage divider, and Thevenin's theorem; application of the oscilloscope; the analysis of the transient response of RC circuits; applications of operational amplifiers in the design of summing, amplification, and comparator circuits; analysis of the frequency response of filter circuits; the design and construction of a karaoke machine. This course cannot be taken for credit by electrical engineering or computer engineering majors. Writing intensive course. (Fall; Spring) Corequisite: EG2423 (either a prerequisite or a corequisite).

EG 2126. Electronics I Laboratory. 1 Semester Hour.
DC circuits; the diode as a nonlinear device; the oscilloscope; RC circuits; RC filters; LC resonant circuit; rectifier; signal diodes; diode clamp; emitter follower; current source; common emitter amplifier; transistor as a switch; op-amp open-loop gain; inverting and non-inverting op-amps; op-amp follower and current source; summing amplifier; op-amp as an integrator, a differentiator, an active rectifier, and an active clamp; FET transistor; FET current source and source follower; FET as a voltage-controlled resistance; amplitude modulation and AM radio; input and output characteristics of integrated gates: TTL and CMOS. (Spring) Prerequisite: EG2121; Corequisite: EG2326.

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.
To build on knowledge students have gained from previous programming and mathematics courses so that they may learn how to apply more sophisticated techniques to the design and analysis of data structures and algorithms. This will allow students to understand and/or conduct assessments of the data structures and algorithms used in modern computer operating systems, application programs, etc. Students will gain experience implementing data structures and algorithms and using these to solve practical engineering problems. (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.

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: EG2421.

EG 2326. Electronics I. 3 Semester Hours.
Physical properties of diodes and p-n junctions; Diode circuits; physical properties of Metal-Oxide Field Effect Transistors (MOSFET); amplification circuits using MOSFET; NMOS; PMOS and CMOS devices; physical properties of Junction Field Effect Transistors (JFET); electronic circuits using JFET; physical properties of Bipolar Junction Transistors (BJT); amplification circuits using BJT; switching circuits using cut off and saturation modes of BJT. (Spring) Prerequisite: EG2421.

EG 2341. 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 only) Pre-requisite: Sophomore standing; Co-requisite: EG 2141. (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 2343. Statics. 3 Semester Hours.
Fundamentals of statics, vector methods, concentrated and distributed force systems, methods of moments for extended rigid structures, static equilibrium 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.
Linear and angular kinematics and kinetics of particles and systems of particles. Work-energy and impulse momentum principles. Planar and three-dimensional kinetics and kinematics of rigid bodies. Dynamic friction. Introduction to vibrations. (Spring) Prerequisites: EG2343 and MT2413.

EG 2346. Strength of Materials. 3 Semester Hours.
Mechanical properties of materials: normal and shear stress, normal and shear strain. Separate treatments of axial load, torsion, and bending. Bending and shearing stresses in beams. Deflection in homogeneous beams. Design of members by strength criteria. (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.
Overview of business operations, valuation, and finance/accounting concepts. Introduction to microeconomic and macroeconomic theories. Fundamental principles and methods for economic analysis of alternatives. Introduction to supply and demand, breakeven, and payback analysis. Effects of time value of money, interest, taxation, depreciation, and inflation. Analysis of banking operations. Introduction to the stock and bond market. Economy of replacement analysis. Introduction to project management. Societal impact of technology. (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. Eng. 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; Spring) Prerequisite: EG1303.

EG 3102. Eng. Design & Analysis Workshop II. 1 Semester Hour.
The course activities emphasize team projects with each student making a unique contribution according to his/her background, functioning effectively on teams, demonstrating leadership, recognize diversity and inclusiveness (of varied perspectives, ideas, skills, or background), and manage project activities by establishing goals, planning tasks, and meeting objectives (using Gantt charts, schedules, scrum, goal setting, and decision matrices), innovation and entrepreneurship. Workshop sessions also focuses on committing to on-time delivery and pursuing necessary follow-up, instilling trust, and loyalty in a team, facing difficult/high-risk actions, 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; Spring) Prerequisite: None.

EG 3112. Digital Sys 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 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.
An introductory laboratory exploring solid mechanics and materials. Students will learn techniques for measuring structural characteristics and materials properties. The principles of materials selection in engineering design are also included. (Fall) Prerequisite: EG2346; Corequisite: EG3341.

EG 3142. Thermodynamics & Fluids Lab. 1 Semester Hour.
An introductory laboratory exploring thermal-fluid engineering. Students will learn techniques for measurement of fluid and thermal properties of solid, liquid and gas, measurement of transport phenomena, calibration of sensors and reference standard and design of experiments. (Spring) Prerequisites: EG3343 and EG3342.

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 3296. Human Factors, Ergonomics and Safety. 2 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 3313. Computer Organization and Architecture. 3 Semester Hours.
Instruction set architecture; addressing modes and instruction formats. Arithmetic Logic Unit (ALU), data paths, and control. Microprogrammed and hardwired control. CPU performance measures. Pipelining; pipelined Data path and control, pipeline hazards. memory hierarchy; basics of caches, cache performance, and principles of virtual memory. (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 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 the HCS12 Motorola microcontroller. The second goal of the course is to introduce and familiarize students with different architecture and hardware design in microcontrollers using HCS12 as a model. The course is accompanied by laboratory assignments throughout the semester. (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 of the Mc9S12DP256 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. The course includes six or seven practical data acquisition and control projects based on the HCS12 microcontroller. (Spring) Prerequisite: EG3323 and EG 2313.

EG 3325. Signals and Systems. 3 Semester Hours.
Continuous signal and system modeling, properties of linear, time-independent systems, BIBO stability, response of continuous systems to periodic and non-periodic signals, the convolution integral, theory and applications of Fourier series and Fourier transforms, power spectrum of periodic signals, energy spectrum of non-periodic signals, sampling. (Fall) Prerequisites: EG1122, EG2324, and MT2333.

EG 3326. Electromagnetic Theory. 3 Semester Hours.
Review of vector analysis, complex vectors, application s of Stokes' theorem and the divergence theorem. Maxwell's equations; elements of electrostatics; the Lorentz force law; introduction to magnetostatics; Faraday's law; time-varying electromagnetic fields; propagation of time¬ harmonic plane waves; Poynting 's theorem; wave attenuation in conductive and dissipative media; polarization; and dispersion. Introduction to transmission lines. (Spring) Prerequisites: EG2324 and MT2333.

EG 3328. Control Systems. 3 Semester Hours.
This course familiarizes students with the fundamentals of automatic control systems, including the analysis and design of control systems for various engineering applications. Topics include modeling of physical systems using both transfer function and state space model, system responses, performance and design criteria, control system characteristics, stability, sensitivity, steady state errors and transient response, stability analyses using Routh-Hurwitz, Root-locus, Nyquist, and Bode methods, lead, and lag compensators, PID controllers, design using root-locus method, and frequency-response analysis. MATLAB and SIMULINK are used to aid in the analysis and design of control systems. The laboratory work is designed to introduce the student to modern techniques needed for the design and implementation of automatic control systems. (Spring) Prerequisite: EG3325.

EG 3341. Materials Engineering. 3 Semester Hours.
A study of the atomic and crystalline structure of solids including the theory of solid solutions, diffusion, and phase transformations. The behavior of matters based on their mechanical, electrical, thermal, magnetic, and optical properties. Point defects, dislocation theory, forensics. Discussions of societal issues in materials science and engineering. (Fall) Prerequisites: CH1401 and MT2412.

EG 3342. Engineering Thermodynamics I. 3 Semester Hours.
Introduction, definitions of different properties of thermodynamics, first law, physical properties, ideal and real gases, second law, reversibility, irreversibility and consequences, thermodynamic cycles. (Spring) Prerequisites: MT2412, PY2404, and CH1401.

EG 3343. Fluid Mechanics. 3 Semester Hours.
Forces and energy generated by liquids and gasses at rest and in motion. Fundamental laws of fluid behavior: conservation of mass, energy, and momentum. Differential and finite control volume approaches for flow analysis. Steady, incompressible flow. (Fall) Prerequisites: EG2343, PY1404, 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.
Introduction to the theory, design, and analysis of dynamic mechanical systems, including modeling of dynamic system response, and design of control systems. Transient and steady-state response analysis of dynamic systems: mechanical systems, electrical and electro-mechanical, and thermal-fluids systems. First and second order linear systems and sources of nonlinearity. Feedback principles and classical control theory. Transfer functions, time and frequency response, vibration, damping, and automatic control systems. Hands-on laboratory experimentation with measurement and instrumentation, calibration, sensors and transducers, data acquisition, and design of controls. (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: EG3341 and 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, EG3341, 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. Students will also be introduced to Finite Element Analysis and Computational Fluid Dynamic principals. (Fall) Prerequisites: EG1294, EG2346, and MT2332.

EG 3353. Engineering Project Management. 3 Semester Hours.
The course explores modern project management by providing an enterprise-level, experiential view of the discipline focused on connecting projects to the organization's mission, vision, and values. The theme of the course is applying key project management tools and techniques, through case-based group work. Groups select, plan, report, and then present on their project's scope, schedule, cost, risk, quality, and communications elements using tools such as the WBS, network diagram, PERT estimate, Gantt chart (including the use of MS Project), risk register, and heat map. Students also gain familiarity with important new concepts in project management: Agile frameworks, sustainability thinking, and Benefits Realization Management (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: none.

EG 3362. Software Design and Architecture. 3 Semester Hours.
This course introduces basic concepts and principles about software design and software architecture. Study of design concepts and notations. Architecture, middleware architectures, design patterns, frameworks, and components. Designing for qualities such as performance, security, reusability, reliability. Techniques for designing, building, and evaluating software architectures. (Spring) Prerequisite: EG3365.

EG 3365. Software Engineering. 3 Semester Hours.
Introduction to Software Engineering, Agile Software Engineering and software development processes, configuration and people management, Requirements Engineering, Software Architecture and Object-Oriented Analysis and Design using UML, user interface design, project management, software testing and quality assurance, security and privacy, cloud-based software, DevOps, and Code Management. (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 Java 2D. 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 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 3376. Unmanned Aircraft Systems II. 3 Semester Hours.
This course is continuation of UAS I and will cover the concepts of communication systems, payload systems, control stations and related systems, vehicle specific systems, and support systems. The requirements for system architecture development and conceptual level assessment of major system elements will be examined as they relate to use in industry. The major system elements will be evaluated from a system engineering perspective to include consideration for cost and weight estimation, basic aircraft performance, safety and reliability, lifecycle topics, vehicle subsystems, and system integration. (Fall) Prerequisites: EG3371 and EG3172.

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 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 test, 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. Output analysis. (Spring) Prerequisite: EG3395.

EG 3398. Six Sigma Quality. 3 Semester Hours.
Statistical process control: data collection and analysis, control charts, process control, capability analysis. Introduction to total quality management (TQM). The DMAIC process. Introduction to Six-Sigma Certification. Failure mode effect analysis. Benchmarking. Kaizen. Poka-yoke. Value stream mapping. Quality function deployment. Integration of 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; Spring) 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. Major elements of measurement systems, including transduction, signal conditioning, analog signal acquisition and digital data acquisition. Introduction to sensor/transducer resolution, sources of measurement errors, measurement uncertainty and statistical analysis, and instrumentation limits. Concepts and techniques in analog signal input measurement, signal conditioning, data display and capture, sampling rates, report generation, image acquisition and analysis, pressure transducers, instrument calibration, multiple channel sampling, and shunt calibration. (Fall) Prerequisites: EG3141, EG3142, EG2123, and EG1341.

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 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. Requires a thorough understanding 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. The course requires industry-university cooperation and status briefings. The senior design sequence consciously integrates and reflects upon the goals and objectives from the four core areas (self, others, nature, and God) and their relationship with engineering. A common reflection theme in the course 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. Specific prerequisites by major: CE: EG 3212 and EG 3313 EE: EG 3321, EG 3324, and EG3226 EM: EG 3394, EG 3396, and EG 3398 ES: Advisor consent IE: EG 3394, EG 3396, and EG 3398; Co-requisite: EG4291 ME: EG 3341, EG 3343, EG 2423, EG 3347, EG 3349, and EG 3348 SE: EG 3160, CS 3340, EG 3361, EG 3362, and CS 4320.

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 4362, this course requires a formal final presentation and comprehensive final report submission. 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 4315. Cryptography Principles and Practices. 3 Semester Hours.
Basic concepts of cryptography, symmetric encryption schemes, review of finite fields, number theory, and elliptic curves, advanced cryptographic schemes, public-key cryptography, MAC, hash functions, and digital signature, key management and distribution, user authentication, and different applications. (Fall) Prerequisites: EG2312 and MT2323.

EG 4316. Computer Networks. 3 Semester Hours.
Fundamentals of computer networking and data communication in the context of the OSI and TCP/IP reference models. Layered protocols and the role of each layer of the combined OSI–TCP/IP reference models; namely the Application layer, the transport layer, network layer, the link layer, and local area networks. Current trend in computer networking, design principles behind computer networks, the quantitative measures to gage the performance of computer networks, and major issues involved in designing high speed 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; physical properties of p-n junction; physical properties of 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.
Introductory information theory; frequency response of linear systems; analog-to-digital conversion; time multiplexing of signals; Pulse Amplitude Modulation (PAM); Pulse Code Modulation (PCM); quantization noise; Amplitude Modulation (AM) and Frequency Modulation (FM) techniques (Spring) Prerequisites: EG3325 and MT4331.

EG 4338. Special Topics I. 3 Semester Hours.

EG 4342. Heat Transfer. 3 Semester Hours.
Fundamental laws of heat transfer by conduction, convection, and radiation; boundary-layer concepts; simultaneous heat, mass and momentum transfer, heat transfer in engineering apparatus. Heat exchangers and heat transfer from extended surfaces. (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 introduces maintenance methodologies and the evolution of software systems. Concepts and techniques for modifying software in evolving environment s. Designing and implementing software to increase maintainability and reuse; evaluating software for change; and validating software changes. Evolution of legacy software systems. Software re-engineering, data reverse engineering. (Spring) Prerequisite: EG3362.

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: 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 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. Introduction to duality and sensitivity analysis. Network flow optimization. (Fall) Prerequisite: MT2318 OR MT2332.

EG 4394. Smart Manufacturing. 3 Semester Hours.
This course covers advanced topics in manufacturing, computer aided manufacturing/design, additive manufacturing, robotics, and internet-of-things and intelligent automated systems. (Elective) Prerequisites: EG4291 and EG2391.

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 OR MT4332.

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 uncertainties for optimal profitability in the context of global outsourcing, international logistics, and international trade treaties. (Spring) Prerequisites: EG3394 and EG3391.