COMPUTER ENGINEERING

Academic Year

2011-2012

School

School of Science, Engineering and TechnologySchool Web site

School Dean

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Department

Engineering

Department Chair

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Description of Program/Major

Today, computers are used in all aspects of business, technology and education. They have become integral parts of automobiles, instrumentation for aeronautics and space exploration, medical devices, factory automation, artificial intelligence systems and telecommunications networks. Computer engineers gain their unique expertise from both the electrical engineering, and computer science disciplines.

The electrical engineering background integrates the theory and design of electronics hardware with the knowledge of electronic circuits and devices, digital logic, digital systems, microprocessors, embedded systems, hardware organization, and computer system architecture.

The computer science background includes software engineering, data structures, operating systems, database design, analysis and design of algorithms, and programming languages.

The computer engineering program at St. Mary's University successfully combines these two disciplines to prepare a new kind of engineer with a solid foundation that provides for the design of both electronic hardware and computer software.

The B.S. in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET.

Degree Requirements

Core Curriculum (SMC)

St. Mary's University Core (30 Hours)

All St. Mary's Core SMC13## "Reflection" courses must be completed before registering for SMC23## "Practice" courses. "Reflection" courses can be taken in any order followed by "Practice" courses in any order.

SMC 1301	Foundations of Civilization	3
SMC 1311	Foundations of Reflection: Self (Formerly PL 1310)	3
SMC 1312	Foundations of Reflection: Nature	3
SMC 1313	Foundations of Reflection: Others	3
SMC 1314	Foundations of Reflection: God (Formerly TH 2301)	3
SMC 2301	Foundations of Practice: Ethics (Formerly PL 2332)	3
SMC 2302	Foundations of Practice: Civic Engagement and Social Action	3
SMC 2303	Foundations of Practice: Fine Arts and Creative Process (Formerly FA 1101, FA 1102, FA 1103)	3
SMC 2304	Foundations of Practice: Literature	3
SMC 4301	Capstone Seminar: Prospects for Community and Civilization	3

School Specific Core (SSC)

School of Science, Engineering, and Technology Specific Core (21 Hours)

Speech	SE 1321 (for international students), SE 1341, SE 2333, SE 3391	3
Composition and Rhetoric (grade of "C" or better)	EN 1311, EN 1313 (for international students)	3
Foreign Languages	Six hours at the sophomore level (2311, 2312) in a Foreign Language previously studied for a minimum of one year; Or, 6 hours of introductory level (1311, 1312) in a Foreign Language not previously studied; Or, 12 hours of CLEP credit for a language previously studied.	6
Social Science	BA 1310, BA 3325, CJ 2300, CJ 3300, EC 2301, EC 2303, PO 1311, PO 1312, PO 1314, PS 1301, PS 3386, SC/CR 1311, SC 3321, HU 3300, HU 3303	3
Theology	Advanced Theology 33XX	3
Fine Arts	AR, DM, MU or Literature: EN 2321, 2322, 2353, 2354, 2355, 2356	3

Four Year Degree Plan

Sample 4-year degree plan

Department Courses and Descriptions

Intro to Computer/Ele E I (1)
EG 1101
Introduction to electrical/computer engineering consist of two 1-hour course sequence directed at incoming freshmen. The two courses focus on MATLAB and its application to engineering problems. In

the first course, EG1101, the basic MATLAB features are covered. This includes MATLAB help utility, MATLAB environment and desktop, all MATLAB windows and their functionalities, solving simple problems using MATLAB, preliminary graphing capabilities of MATLAB, m-file development, debugging m-files with MATLAB, solving more sophisticated engineering problems with MATLAB. Pre-requisite: none.

Intro to Computer/ EE II (1)
EG 1102
Introduction to electrical/computer engineering consist of two 1-hour course sequence directed at incoming freshmen. The two courses focus on MATLAB and its application to engineering problems. In the second course, EG1102, the more advanced MATLAB features are covered. This includes m-file and its debugging features, flow control in MATLAB, more advanced usage of MATLAB help utilities, more advanced MATLAB commands, MATLAB toolboxes, solving advanced engineering and scientific problems using MATLAB, more advanced graphing capabilities of MATLAB. Pre-requisite: EG 1101.

Engineering Graphics and Desig (3)
EG 1301
Introduction to drawing instruments, lettering, and sketching. Work drawings: pictorials, orthographic projection, dimensioning, sections, and auxiliary views. Descriptive geometry: points, lines, planes, revolutions, intersections, etc. Use of Computer Aided Design (CAD) software. Introduction to engineering design. Several design projects are developed. Prerequisite: none.

Programming for Engineers (3)
EG 1302
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 empha ize 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. Prerequisite: none.

Engineering Programming (3)
EG 1304
This course is to provide students with a working knowledge of C programming language as defined by the ANSI standard. Good programming habits and well-structured coding are emphasized. Introduction to structured programming, simple elementary examples, program control, repetition, selection, arrays, input/output and file processing, scoping, functions, local and global variables, modular programming, top-down design, strings, pointers, structures, binary numbers, and dynamic memory allocation. Extensive use of structured programming. Prerequisite: none.

Object-Oriented Program &Desig (3)
EG 1305
Introduction to object-oriented programming, classes, objects, data members (class attributes), methods (member functions or class behavior), data abstraction, and encapsulation. Software reuse. Constructors,

destructors, and inheritance. Operator overloading. Virtual functions and polymorphism. Stream Input/Output. The preprocessor. Object-oriented analysis and design methodologies and their role in the software development process. The Unified Modeling Language (UML) as a design and development tool. Extensive use of OOP programming is required. A class project is included requiring use of the UML to develop a sizable software application. A professional oral presentation and a well-written report are required. Prerequisite: EG 1302 or EG 1304 or CS 1410.

Engineering Seminars (0)
EG 2010
The engineering seminars provides students exposure to outside speakers and a review of recent developments in science and engineering. Prerequisite: none.

Logic Design Laboratory (1)
EG 2141
This lab introduces the basic principles of digital electronic design using standard TTL devices. Experiments illustrate the principles learned in the Fundamentals of Logic Design (EG 2341) 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. Co-req uisite: EG 2341.

Circuit Analysis Laboratory (1)
EG 2152
This lab is geared towards students who are taking electrical engineering laboratory for the first time. The lab is divided into two parts: First part covers introductory concepts and basic measurements in electrical circuits. Second part is dedicated to circuit theorems; transient response of circuits composed of resistors, capacitors, and inductors; AC steady state; frequency response (PHASORS); and the characteristics of operational amplifiers in electrical circuits. Co-requisite: EG 2353.

Digital Systems Design Lab (1)
EG 2181
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 and fan-out of TTL and CMOS devices; Tri-state 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. Prerequisites: EG 2341and EG 2141W; Co-requisite: EG 2382.

High Technology & Society (3)
EG 2300
Exploration of the social, economic, and political impact of modern science and technology. The ethical nature of scientific research and technological development. Exploration of recent scientific discoveries

and technological applications. This course may be counted for physical science credit for social science majors and social science credit for SET majors.

Principles of Materials Scienc (3)
EG 2306
A study of the atomic and crystalline structure of solids including the theory of X–ray diffraction, solid solutions, diffusion, and phase transformations. The behavior of matters based on their mechanical, electrical, thermal, magnetic, and optical properties. Point defects, dislocation theory. Prerequisites: CH 1401, PY 2404, MT 2412.

Engineering Mechanics (3)
EG 2307
Fundamentals of statics, vector methods, concentrated and distributed force systems, methods of moments for extended rigid structures, static equilibrium of structures. Prerequisites: PY 1404, MT 2412.

Strength of Materials (3)
EG 2308
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. Prerequisite: EG 2307, MT2413.

Fluid Mechanics (3)
EG 2309
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. Prerequisites: MT 3311, PY 2404, EG 2307.

Human Computer Interaction (3)
EG 2310
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. 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 de sign, implement and evaluate computer interfaces. Prerequisite: EG1302 or EG1304 or CS 1410.

Software Requirement Eng (3)
EG 2311
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 valida tion techniques, including need, goal, and use case analysis. Students participate in a group project on software requirements. Prerequisite: EG 1302 or EG 1304 or CS 1410.

Work Design & Product Measure (3)
EG 2322

Industrial engineering tools and concepts for engineering problem solving. Work design and methods engineering. Work measurement and work sampling, productivity measurement, incentives, standard time techniques. In-class labs and design projects are required. Prerequisites: none.

Industrial Automation & Contro (3)
EG 2325
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. Prerequisite: EG1302, EG1304, CS1410, or CS 1411.

Fundamentals of Logic Design (3)
EG 2341
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. Co-requisite: EG 2141W.

Data Structures & Algorithms (3)
EG 2342
This course provides an introduction to the design and analysis of computer data structures and algorithms, focusing in particular on techniques for achieving high performance software in computer systems. Students will learn the necessary mathematical background to carry out algorithm analysis, such as time and space complexity, worst-case and average-case analysis, tractability & intractability, and design techniques. It discusses recursion and recurrence relations, asymptotic notations, basic data structures, dynamic dictionaries, balanced trees, priority queues, and graphs. The specific data structures which will be discussed in class include linked lists, stack, heaps, self-organizing lists, binary search trees, hash tables, AVL trees, red-black trees, balanced trees, leftist trees, minimum spanning trees, and others. Prerequisite: EG1302 or EG1304

Circuit Analysis I (3)
EG 2352
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. Prerequisite: PY2404. Co-req uisite: MT3311.

Circuit Analysis II (3)
EG 2353
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. Prerequisites: EG 2352, MT 3311.

Digital Systems Design (3)
EG 2382
The first part of this course presents a quick review of sequential network design concepts as presented in the pre-requite course on Fundamentals of Logic Design (EG 2341); iterative networks; integrated circuit logic families and their electric characteristics; drive capability and fan-out of TTL and CMOS devices; Tri-state buffers, and Open-collector outputs. Mixing logic families; Hazard detection and prevention; designing digital systems using Programmable Logic Devices (PLD); digital systems design using Algorithmic State Machine (ASM) charts. The second part of this course focuses on the 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. Prerequisites: EG 2341and EG 2141W; Co-requisite: EG 2181W.

Artificial Intelligence (3)
EG 2390
Introduction to Artificial Intelligence. Search techniques, knowledge representation, game playing, predicate logic. Knowledge representation using rules, expert systems, neural networks, and genetic algorithms. Coverage of an AI-specific programming language and/or AI integrated software. Prerequisite: EG 1304 or EG 1302.

Expert Systems ad Applications (3)
EG 2393
Fundamentals of expert systems. Knowledge representation using production rules. Knowledge acquisition and development of a knowledge base. Backward and forward chaining. Uncertainty. Development, testing, and validation of expert systems. Prerequisite: EG1302 or EG 1304.

Circuits and Systems Lab (1)
EG 3145
Basis of electrical measurements and technical report writing. Experimental verification and applications of circuit theorems and laws including the current divider, the voltage divider, and Thevenin’s theorem;, the application of the cathode ray oscilloscope; the analysis of the transient response of RC and RL circuits; applications of operational the amplifiers in the design of summing, amplification, and comparator circuits; design of diode-clamping circuits; implementation and analysis of frequency response of filter circuits. This is a writing-intensive course. This course cannot be taken for credit by electrical engineering or computer engineering majors. Prerequisite: EG 3345

Electronics I Lab (1)
EG 3156
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. Pre -requisite: EG 2152W; corequisite: EG 3356.

Electronics II Lab (1)
EG 3157
Flip-flops; counters; shift registers; the cascading 16-bit counter with added display and keypad; programmable divide-by-n counters; period meters; capacitance meters; memory; RAM; divide-by-3; memory-based state machines; the dynamic diode curve tracer; the grounded emitter amplifier; current sources; the Ebers-Moll model; push-pull amplifiers; differential amplifiers; the bootstrap circuit; the Miller effect; the Darlingtonpair; the super beta; the analog switch and its applications: chopper circuits; sample-and-hold circuits; switched capacitor filters; voltage inverter circuits; A/D and D/A converters; the phase-locked loop circuit; the frequency multiplier. Prerequisite: EG 3156W; Co-requisite: EG 3357.

Human Factors (3)
EG 3316
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.

Industrial Statistics (3)
EG 3322
Introduction to probability and statistics; descriptive statistics; random variables; sampling; distributions; hypothesis testing; linear regression and correlation; goodness-of-fit tests; design of experiments and analysis of variance. Pre-requisite: MT2413

Lean Production Systems (3)
EG 3333
Principles and methods of analysis and design of service, production, and manufacturing facilities. Plant layout. Assembly line balancing. Material handling. Lean and just-in-time. Forecasting. Inventory control. Aggregate planning. Materials requirement planning. Theory of constraints. Prerequisite: MT 2413.

Engineering Economy (3)
EG 3334
Overview of finance/accounting concepts. Fundamental principles and methods for economic analysis of technical alternatives leading to decision making under deterministic and uncertain conditions. The effects of interest, taxation, depreciation, and inflation. Prerequisite: MT 2413 Calculus II.

Optimization (3)
EG 3335
Introduction to mathematical programming. Linear program formulations. Optimization of linear programs using the graphical method, simplex method and special implementations of the simplex method. Duality. Sensitivity analysis. Transportation and assignment problems. Introduction to integer programming. Integer program formulations. Co-requisite: MT 2413.

Applied Optimi. & Analysis (3)

EG 3336
Introduction to network optimization. Network representation and solution algorithms for minimum spanning tree, shortest path, minimum cost network flow and maximum flow - minimum cut problems. Scheduling of projects using CPM/PERT. Formulation and solution of dynamic programming problems. Introduction to heuristics and meta-heuristics. Introduction to stochastic modeling. Markov chains, Chapman-Kolmogorov equations and classification of states. Introduction to queuing systems. Birth-death processes, queuing networks and queuing decision models. Prerequisites: EG 3332 or MT 4331.

Supply Chain Management (3)
EG 3337
Fundamental concepts and theory for the treatment of 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, global manufacturing & distribution, supply chain profitability optimization. Decision making under uncertainty for optimal profitability in the context of global outsourcing, international logistics, and international trade treaties. Prerequesite: EG 3333

Circuits and Systems (3)
EG 3345
An introduction to the 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. This course may not be taken for credit by electrical engineering or computer engineering majors. Prerequisite: PY 2404; Co-requisite: MT 3311

Software Design & Archi (3)
EG 3350
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. Prerequisite: CS 3340 and EG 2311.

Software Project Management (3)
EG 3351
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. Prerequisite: CS 3340.

Software Qual Assurance & Test (3)
EG 3352
This course provides an introduction to software quality assurance and testing. Quality assurance process and its role in software development. Measuring software quality and software quality standards. In spections and formal technical reviews. Testing, verification, and validation techniques. Black-box and white-box testing. The automation of software testing. A team-based software development project is required in which students apply learned techniques. Prerequisite: CS3340.

Electronics I (3)
EG 3356
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. Prerequisite: EG2352.

Electronics II (3)
EG 3357
The second part of a two-semester course sequence, which focuses on analog electronic circuits. Differential and multi-stage amplifiers; feed back 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. The MultiSIM circuit analyzer software package is heavily utilized. Prerequisite: EG 3356; co-requisite: EG 3157W.

Microprocessors I (3)
EG 3363
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 in particular. 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. Prerequisites: EG 1302/04, EG 2341.

Microprocessors II (3)
EG 3364
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. Pre -requisites: EG 3363.

Electromagnetic Theory (3)
EG 3366

Review of vector analysis, complex vectors, applications of Stokes' theorem and the divergence theorem, Maxwell's equations, the Lorentz force law, Poynting's theorem, electrostatics, introduction to magnetostatics, Faraday's law, time-varying electromagnetic fields, propagation of time-harmonic plane waves, wave attenuation in conductive and dissipative media, dispersion. Introduction to transmission lines. Prerequisites: PY2404, MT3311, MT3315, EG2352. Co-requisite: EG2353

Semiconductor Devices (3)
EG 3368
Review of quantum mechanics; introduction to crystallography; energy band and charge carriers; physical properties of the p-n junction; physical properties of diodes; physical behavior of Bipolar Junction Transistors (BJT) in active, saturation and cut-off modes. Prerequisites: EG3356 and senior standing.

Signals and Systems (3)
EG 3372
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, modulation. Prerequisite: MT3311, EG2353.

Computer Organi & Architecture (3)
EG 3374
Instruction set architecture: instruction types, data types, addressing modes, instruction formats, and RISC versus CISC architectures. Basic computer organization: Central processing unit, system buses, memory subsystems, and computer peripherals. Processor design: hardwired versus micro-programmed control unit, arithmetic logic unit, pipeline design, pipeline hazards, branch prediction, register windowing, register renaming, and instruction level parallelism. Memory hierarchy: cache organizations, cache placement and replacement policies, main memory, virtual memory, and memory protection. Performance measurements. Prerequisites: EG2341, EG2382.

Java and Applications (3)
EG 3392
Introduction to Java applications and Applets. Control structures. Methods of Java API packages. Declaring and allocating arrays. Object- oriented programming. Constructors and finalizers. Inheritance, super classes, and subclasses. Private, protected, and public members. Polymorphism. strings and characters. Graphics and Java 2D. Graphical User Interface (GUI) components. Layout managers. Event-driven programming. Exception handling. Multithreading. Files and streams. Networking. Accessing databases with JDBC. Servelets. Java Server Pages (JSP). Extensive use of Java programming. A term-project is required. Prerequisites: EG 1302 or EG 1304 or CS 1410, and EG 1305.

Computer Aided Manf&Rob Lab (1)
EG 4132
Operations and programming of stepper and servomotors; integration of discrete-event sensors with microcomputer interfaces. Programming, simulation, implementation, and applications of industrial robots and microcontrolers. Experiments on computer numerical control (CNC) programming and coordinate measuring machines (CMM). Solid modeling on CAD. Weekly written reports on experiments are required. Co-requisite: EG 4332.

Energy Conversion Lab (1)
EG 4160
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. Co-requisite: EG4360

Adv Electronics Design Lab (1)
EG 4166
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. Prerequisite: EG 3357; Co-requisite: EG 4366.

Quality Control & Reliability (3)
EG 4330
Statistical process control, interpretation of data, troubleshooting, control charts, process control, acceptance sampling. Fundamental reliability concepts, reliability functions, probabilistic engineering design. Relationship between statistical process control and total quality management (TQM). Malcolm Baldrige National Quality Award. ISO 9000. The quality gurus: Deming, Crosby, and Juran. Benchmarking. Quality function deployment. Prerequisite: MT4331 or EG3322 .

Manufacturing Processes (3)
EG 4331
Geometric dimensioning and tolerancing standards. Economical and environmental considerations in manufacturing. Selection of materials. Processing methods: casting, injection molding, assembling, machining, etc. Measuring and inspection equipment and techniques. Product data management. Product design and redesign. Rapid prototyping. In-class labs and design projects are required. Prerequisite: EG2325.

Computer Aided Manufacturing (3)
EG 4332
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. Prerequisite: EG2325

Computer Simulation (3)
EG 4337
Discrete-event simulation. Extensive use of Monte Carlo Simulation Software. Model verification and validation. Statistics of simulation. Prerequisites: EG 3322 or MT 4331

Special Topics I (3)
EG 4338

Special Topics II (3)
EG 4339

Industrial Senior Desgn Proj I (3)
EG 4340
The first course in the six-hour senior design sequence for IE, EM, SECA, and ES majors. Industry-university cooperation is required. Intended to foster a thorough understanding of the iterative engineering design process, including the recognition of needs, requirements planning, analysis and design, implementation, testing, validation, and impact on society. Prerequisites for IE majors: completion of at least 18 hours out of the following set: EG 2322, EG3333, EG3334, EG3335, EG3336, EG4132, EG4330, EG4331, EG4332, EG4337, EG3316, and ei ther EG3322 or MT4331

Industrial Snr Dsgn Prjct II (3)
EG 4341
This course is a continuation of EG4340W. Prerequisite: EG 4340W.

Digital Signal Processing (3)
EG 4350
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. Prerequisite: EG 3372

Formal Methods of Sofware Eng (3)
EG 4351
The goal of this course is to teach the formal methods of specifying and verifying software. Review of mathematical foundation for formal methods. Formal languages and techniques for specification and design, including specifying syntax using grammars and finite state machines. Analysis and verification of specification and designs. Use of assertion and proofs. Automated program and design transformation. Prerequisite: MT 3323.

Software Maint & Evolution (3)
EG 4352
This course introduces maintenance methodologies and the evolution of software systems. Concepts and techniques for modifying software in evolving environments. 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. Prerequisite: CS 3340.

Computer Networks (3)
EG 4356
Principles of layered communication architecture: application layer protocols, transport layer services, network layer and routing, data link layer, and physical layer. Local area networks: IEEE standard 802 for LANs (Ethernet, Token Bus, Token Ring,), Asynchronous Transfer Mode (ATM), hubs, bridges, and switches, high speed LANs, satellite and wireless LANs. Circuit switching, packet switching, and

message switching, Error detection, error correction, security in computer networks, multimedia networking, and performance modeling. Prerequisite: junior standing

Energy Conversion (3)
EG 4360
Three-phase circuits, magnetic circuits, transformers, electrical-mechanical transducers, dc motors, synchronous motors, induction motors, ac generators.Theoretical principles, matematical models, operating characteristics, and practical applications of transformers, motors, and generators are emphasized. Prerequisites: PY1404, PY2404, MT3311, EG2352, EG2353.

Comp & Elect Snr Design Proj I (3)
EG 4362
This is a first course in the six-hour senior design sequence for EE and CE majors. It is intended to foster a thorough understanding of the engineering design process, from the recognition of a need and the definition of design objectives through implementation and troubleshooting. Industry-university cooperation is encouraged. This course requires proposal submission, alternative design consideration, status briefings, implementation, budgeting, and the preparation of a comprehensive final written report and oral presentation by the students. Prerequisites: Senior standing; EG 3357; EG 3364.

Comp & Elect Snr Design Prj II (3)
EG 4363
This course is a continuation of EG 4362W. Prerequisite: EG 4362W.

Advanced Elec Design (3)
EG 4366
This is a practical design course at the integrated circuit level. The topics include operational amplifier applications, feedback, active filters, oscillators, voltage regulators, linear and switching power supplies, precision and low noise techniques, and digital circuits. Prerequisite: EG 3357.

Control Systems (3)
EG 4369
Introduction to 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 models. 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 and PID controllers design using root-locus method; 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. Prerequisite: EG3372 Signals and Systems

Communication Theory (3)
EG 4370
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:

Prerequisite: EG3372

SECA & ES Senior Dsgn Proj I (3)
EG 4395
The first course in the six-hour senior design project sequence for Software Engineering and Engineering Science majors. It fosters a thorough understanding of a comprehensive effort, iterative and incremental in nature, involving problem identification, requirements planning, proposal preparation, analysis, preliminary design, detailed design, development, implementation, and testing. Frequent oral presentations and written report upgrades are expected. Industry-University cooperation is encouraged. Students have a final professional oral presentation and submit a comprehensive report. Prerequisites: senior standing and consent of the academic adviser.

SECA & ES Senior Dsgn Proj II (3)
EG 4396
Continuation of EG 4395W. Prerequisite: EG 4395W.

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