EE Curriculum and Course Outcome Sequence

The curriculum for the EE program is listed below. This is the main process by which the department implements its educational mission. The syllabi for each EE course can be found at http://www.engr.uky.edu/~donohue/abet/abetsylb.html, which contain the syllabi for each of these courses. The outcome sequences of each EE curriculum specialty are presented after tables.

Freshman Year		**Sophomore Year**	
First Semester	**Hrs**	**First Semester**	**Hrs**
EE 101 Electrical Engineering Professions Seminar	1	MA 213 Calculus III	4
MA 113 Calculus I	4	PHY 232 General University Physics	4
CHE 105 General College Chemistry I	3	PHY 242 General University Physics Laboratory	1
CS 115 Introduction to Computer Programming	3	EE 211 Circuits I	4
ENG 101 Writing I	3	University Studies Oral Communication	3
University Studies*	3	**Second Semester**	
Second Semester		MA 214 Calculus IV	3
MA 114 Calculus II	4	EE 221 Circuits II	3
CHE 107 General College Chemistry II	3	EE 222 Electrical Engineering Laboratory I	2
PHY 231 General University Physics	4	Engineering/Science Elective (A)[2]	3
PHY 241 General University Physics Laboratory	1	EE 280 Design of Logic Circuits	3
ENG 102 Writing II	3	University Studies*	3
Junior Year		**Senior Year**	
First Semester	**Hrs**	**First Semester**	**Hrs**
EE 415G Electromechanics	3	Technical Elective[3]	3
EE 416G Energy Conversion Laboratory **or** EE 481 Logical Design Laboratory	2	Engineering/Science Elective (A/B)[2]	3
EE 421G Signals and Systems I	3	Electrical Engineering Technical Elective**	3
EE 461G Introduction to Electronics	3	Electrical Engineering Technical Elective**	3
EE 380 Computer Organization	3	University Studies*	3
Mathematics Selection[1]	3	University Studies*	3
Second Semester	**Hrs**	**Second Semester**	**Hrs**
EE 422G Signals and Systems II	3	EE 499 Electrical Engineering Design	3
EE 462G Electronic Circuits Laboratory	2	Electrical Engineering Technical Elective**	3
EE 468G Fields and Waves	4	Electrical Engineering Technical Elective**	3
Engineering/Science Elective (B)[2]	3	Supportive Elective***	3
Engineering/Science Elective (A/B)[2]	3	University Studies*	3
University Studies*	3		

*To be selected from **University Studies** areas in Social Sciences, Humanities, Cross-Cultural and Cross-Disciplinary in consultation with the academic adviser. A minimum of 18 credits in the humanities and social sciences are required with sufficient breadth and depth as required by the University Studies Program.

***__Supportive elective__ is to be chosen from any University courses, excluding more elementary versions of required courses, such as precalculus mathematics or PHY 211.

[1]**Math Elective**, any course from the list below:
MA320 Introductory Probability

MA321 Introduction to Numerical Methods
MA322 Matrix Algebra and Applications

[2]**Engineering/Science Electives:** to be chosen in consultation with the academic adviser from **Group A:**
MSE 212 Electrical Properties of Materials
ME 220 Engineering Thermodynamics I
EM 221 Statics
EM230 Mechanics for Electrical Engineers (cannot take if have credit in EM 221)
ME 330 Fluid Mechanics
EM 313 Dynamics

Group B:
CS 215 Introduction to Program Design, Abstraction, and Problem Solving
CS 216 Introduction to Software Engineering
CS 222 Computer Science for Electrical Engineers
CS 315 Algorithm Design and Analysis
PHY 308 Principles of Optics
PHY 361 Principles of Modern Physics
MA 432G Methods of Applied Mathematics
MA 433G Introduction to Complex Variables

[3]The **technical elective** may be selected from upper division engineering, mathematics, statistics, computer science, physics, or other technically-related fields in consultation with the academic adviser.

EE Technical Electives: Courses recommended as electrical engineering technical electives are listed below (each course is worth 3 Hours).
EE 511 Introduction to Communication Systems
EE 512 Digital Communication Systems
EE 517 Advanced Electromechanics
EE 518 Electric Drives
EE 522 Antenna Design
EE 523 Microwave Circuit Design
EE 524 Solid State Physics
EE 525 Numerical Methods and Electromagnetics
EE 527 Electromagnetic Compatibility
EE 530 Robotics
EE 537 Electric Power Systems I
EE 538 Electric Power Systems II
EE 560 Semiconductor Device Design
EE 561 Electric and Magnetic Properties of Materials
EE 562 Analog Electronic Circuits
EE 564 Digital Electronic Circuits
EE 565 Circuit Design With Analog Integrated Circuits
EE 567 Introduction to Lasers and Masers
EE 568 Fiber Optics
EE 571 Feedback Control Design
EE 572 Digital Control of Dynamic Systems
EE 581 Advanced Logical Design
EE 582 Hardware Description Languages and Programmable Logic
EE 583 Microprocessors
EE 585 Fault Tolerant Computing
EE 586 Communications and Switching Networks
EE 587 Microcomputer Systems Design
EE 599 Topics in Electrical Engineering (subtitle required)

The following tables list our EE courses with the expected student outcomes for each. Each specific outcome is related to the general engineering skills specified by the Accreditation Board of Engineering and Technology (ABET) with the letters listed below. Each table beyond the Common-Area Course Table follows the course sequence in each of the following focus areas, communications and control systems, electromechanics and power systems, electromagnetics, microelectronics, computer engineering.

ABET Outcome designation:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Semester	Common-Area Course Sequence and Outcomes	Relationship to ABET Outcomes
1	**EE101 Electrical Engineering Professions Seminar (1 Credit Hour)** 1. Knowledge of academic requirements for an undergraduate degree in electrical engineering. 2. Knowledge of ethical and professional issues associated with the electrical engineering profession. 3. Ability to use word processing, spreadsheets, computer networks, literature search techniques, e-mail, and computer software for the solution of very simple electric networks.	**EE101** 1. Advising Component 2. f 3. g, j
3	**EE211 Circuits I (4 Credit Hours)** 1. Ability to analyze simple resistive circuits including those containing operational amplifiers and controlled sources with loop and nodal analysis. 2. Ability to analyze simple steady-state RLC circuits with sinusoidal excitation sources with loop and nodal analysis. 3. An ability to use SPICE (computer simulation package) to verify solutions.	**EE211** 1. a 2. a 3. a, k
	EE221 Circuits II (3 Credit Hours) 1. Ability to derive transfer functions, differential equation representations, and two-port parameters from circuits containing independent sources, dependent sources, resistors, capacitors, inductors, operational amplifiers, transformers, and mutual inductance elements. 2. Ability to solve for circuit outputs (voltages and currents) when circuit is driven by combinations of DC, sinusoidal, and singularity function sources, and the ability to apply superposition for multiple or complex sources. 3. The ability to use SPICE for determining circuit outputs (voltages and currents) when combinations of DC, sinusoidal, and singularity function sources drive circuit. 4. Ability to describe a solution with functional block diagrams (top-down design approach). 5. Ability to work as a team to formulate and solve an engineering problem. 6. Ability to use computer programs (such as MATLAB and SPICE) for optimizing design parameters and verify design performance. **EE222 Electrical Engineering Laboratory I (2 Credit Hours)** 1. Ability to operate basic electrical engineering equipment such as the digital voltmeter, DC power supply, signal generator, and oscilloscope. 2. Ability to collect data and maintain a laboratory notebook in an organized and ethical manner. 3. Ability to analyze and measure DC and AC voltages and currents in linear circuits. 4. Ability to analyze and construct basic operational amplifier circuits (such as summers and filters) and measure input and output voltages. 5. Ability to conduct an experiment, collect data, quantify measurement error, and convey this information in a technical report. **EE280 Design of Logic Circuits (3 Credit Hours)** 1. Ability to perform arithmetic in the various number systems. 2. Ability to apply Boolean Algebra to minimize the design of a logic circuit. 3. Ability to design combinational logic circuits, and use a computer simulator to verify the operation of the circuit. 4. Ability to design synchronous and asynchronous sequential circuits, and use a computer simulator to verify the design. 5. Ability to apply timing analysis to design a reliable circuit when multiple signal paths are involved.	**EE221** 1. a, k 2. a, k 3. a, k 4. a, c, e, g, k 5. a, c, d, e, g, k 6. a, c, e, g, k **EE222** 1. k 2. f, g 3. a, b ,k 4. a, b, k 5. a, b, c, g, k **EE280** 1. a, k 2. a, k 3. a, c, k 4. a, c, k 5. a, c, e, k

Common-Area Courses.

Semester	Communications and Control System-Area Course Sequence and Outcomes	Relationship to ABET Outcomes
5	**EE421 Signals and Systems I (3 Credit Hours)** 1. Ability to classify systems based on properties of their input-output relationship. 2. Ability to analyze and synthesize signals using the definitions and properties of the Fourier series and Fourier transform. 3. Ability to apply convolution, Fourier series, and Fourier transform methods to determine the output of linear time-invariant systems. 4. Ability to analyze and design simple modulation systems and filters.	**EE421** 1. a, k 2. a, k 3. a, k 4. a, c, k

	5. Ability to define a random experiment; its outcomes, events, and probability distribution. 6. Ability to apply independence of events, conditional probability, and Bayes rule to random experiments. 7. Ability to calculate the probability of an event given the cumulative distribution function or probability density function of its random variable. 8. Ability to determine the mean, variance, and standard deviation of a random variable. 9. Ability to determine the autocorrelation and power spectral density of a random signal. 10. Ability to characterize LTI system response to random signal.	5. a, k 6. a, k 7. a, k 8. a, k 9. a, k 10. a, k
6	**EE422 Signals and Systems II (3 Credit Hours)** 1. Ability to analyze discrete-time signals with the (discrete) Fast Fourier transform. 2. Ability to analyze discrete-time systems with the difference equations and Z-transforms. 3. Ability to characterize input-output relationships of linear time-invariant discrete-time systems using impulse responses, transfer functions, and state-variable representations. 4. Ability to analyze linear continuous-time systems with the Laplace transforms and solve their state-equations. 5. The ability to design basic digital filters and feedback control systems.	**EE422** 1. a, k 2. a, k 3. a, k 4. a, k 5. a, c, e, k
7 and 8	**EE511 Introduction to Communication Systems (3 Credit Hours)** 1. Ability to analyze basic communication systems involving random signals, filtering, sampling, and modulation. 2. Ability to design basic communication systems. 3. Ability to describe the reasoning behind design decisions. **EE512 Digital Communications Systems (3 Credit Hours)** 1. Knowledge of operations and issues associated with digitization and information transmission: sampling, encoding, quantization, distortion, channel capacity, and matched filtering. 2. Ability to estimate sampling rate, distortion, and transmission bit rate in a digital communication system. 3. Ability to analyze digital modulation techniques and digital transmission media. 4. Ability to design basic digital communications systems. **EE530 Robotics (3 Credit Hours)** 1. Ability to analyze and design industrial mobile robots 2. Ability to model mechanical manipulators and electromechanical drive systems 3. Ability to apply control technique to optimize motion trajectories **EE571 Feedback Control Design (3 Credit Hours)** 1. Ability to reduce functional block diagrams into state space or frequency domain models 2. Ability to analyze these models using time domain and frequency domain techniques 3. Ability to simulate and realize models, controllers, and compensators using MATLAB or analog electronics. 4. Ability to obtain block diagrams of real-world dynamic systems using time response, frequency response, and steady-state DC methods. 5. Ability to design continuous state feedback regulation, tracking, and estimation schemes for continuous time MIMO systems as well as ability to design analog compensators for SISO systems based upon root-locus and frequency methods. **EE572 Digital Control of Dynamic Systems (3 Credit Hours)** 1. Ability to obtain discrete models (both state space and transfer function) of discrete-time and continuous-time dynamic systems as well as the ability to analyze the resulting models. 2. Ability to design discrete feedback regulation, tracking, and estimation schemes for MIMO systems. 3. Ability to design digital filters (compensators) for SISO systems based upon root-locus and frequency methods. 4. Ability to implement these designs on a physical system utilizing an industrial microcontroller (68HC11).	**EE511** 1. a, k 2. c, e 3. g **EE512** 1. a, j, k 2. a, k 3. a, k 4. a, c, e, k **EE530** 1. a, c 2. a ,k 3. a, c **EE571** 1. a, k 2. a, k 3. a, k 4. a, b, d, k 5. a, b, c, d, e, g, k **EE572** 1. a, b, d, k 2. a, c, k 3. a, c, k 4. c, k
8	**EE499 Electrical Engineering Design (3 Credit Hours)** 1. Ability to effectively work in groups to develop and propose engineering solutions. 2. Ability to apply previously acquired engineering principles as well as learn new principles in solving a large engineering design problem. 3. The ability communicate and thoroughly document the results of an engineering design project to the engineering community using a variety of media (report, web page)	**EE499** 1. b, d, g, k 2. a, b, c, d, i, k 3. b, g, k

Communications and Control System-Area Courses

Semester	Electromechanics and Power Systems Course Sequence and Outcomes	Relationship to ABET Outcomes
5	**EE415G Electromechanics (3 Credit Hours)** 1. Ability to analyze and design simple linear and nonlinear magnetic circuits, and to include the effects of leakages and saturation. 2. Ability to develop equivalent circuits of coupled electromagnetic circuits, in particular power transformers. 3. Ability to calculate the performance characteristics of power transformers from their equivalent circuits. 4. Ability to view rotating electric machines, such as induction, synchronous and dc machines, as coupled	**EE415G** 1. a, c, k 2. a, c, k 3. a, c, k 4. a, c, k

	circuits in relative motion 5. Ability to develop their respective equivalent circuits to evaluate the machine's performance. 6. The ability to formulate tests to determine the equivalent circuit parameters of the various devices (viz. Transformers and rotating machines). **EE 416 Energy Conversion Laboratory (2 Credit Hours)** 1. Ability to apply the principles of electric machines and transformers to set up an experiment. 2. Knowledge of operation, protection, and safety means for electric machines and transformers. 3. Ability to experimentally verify the equivalent circuit models for transformers and electric machines.	 5. a, k 6. a, e, k **EE416** 1. a, c 2. b, k 3. a, b, k
7 and 8	**EE517 Advanced Electromechanics (3 Credit Hours)** 1. Ability to compute the inductance or capacitance of standard structures using the integral form of Maxwell's equations. 2. Ability to design a basic inductor. 3. Ability to use energy or co-energy to calculate the force of electrical origin for either an inductive or capacitive system. 4. Ability to compute the static equilibrium of an electromechanical system and determine its stability. 5. Ability to compute mutual and self inductance. 6. Ability to draw the basic circuit model of the synchronous and induction motors. 7. Ability to apply field transformations for both electric and magnetic systems to the brush DC motor and the homopolar motors. 8. Ability to apply the Maxwell stress tensor for both electric and magnetic systems calculate the force on the object in that volume. 9. Ability to design a basic electromechanical device. **EE518 Electric Drives (3 Credit Hours)** 1. Knowledge of the capabilities and limitation of power semiconductor switching devices. 2. Ability to analyze and design common circuit topologies for power conditioning operation. 3. Ability to predict the performance of electric machines under variable voltage, variable frequency operation. **EE537 Electric Power Systems I (3 Credit Hours)** 1. Ability to apply the concepts of active and reactive powers, the power triangle and per unit quantities to solve power system engineering problems. 2. Ability to develop single-line and reactance diagrams of simple power systems. 3. Ability to develop equivalent circuits of power transformers and synchronous machines and analyze them in a power system. 4. Ability to derive the circuit parameters of power transmission lines, represent them by their equivalent circuits, and calculate their performances. 5. Ability to apply the admittance and impedance models of networks to facilitate power system calculations. **EE538 Electric Power Systems II (3 Credit Hours)** 1. Knowledge of basic power system concepts. 2. Ability to apply analysis techniques relating to power flow, fault calculations, and system stability. 3. Ability to use commercially available software for the analysis, evaluation, and design of electric power systems.	**EE517** 1. a, k 2. a, c, k 3. a, k 4. a, k 5. a, k 6. a, k 7. a, k 8. a, k 9. a, c, e, k **EE518** 1. k, j 2. a, c, k 3. a, c, k **EE537** 1. a, c, e, k 2. a, k 3. a, c, k 4. a, c, k 5. a, k **EE538** 1. k 2. a, k 3. a, c, e, k
8	**EE499 Electrical Engineering Design (3 Credit Hours)** 1. Ability to effectively work in groups to develop and propose engineering solutions. 2. Ability to apply previously acquired engineering principles as well as learn new principles in solving a large engineering design problem. 3. The ability communicate and thoroughly document the results of an engineering design project to the engineering community using a variety of media (report, web page)	**EE499** 1. b, d, g, k 2. a, b, c, d, i, k 3. b, g, k

Electromechanics and Power System Courses

Semester	Electromagnetics Course Sequence and Outcomes	Relationship to ABET Outcomes
6	**EE468G (4 Credit Hours)** 1. Understanding of electrostatic, magnetostatic and electromagnetic fields and their interaction with matter. 2. Ability to solve basic canonical electrostatic, magnetostatic and electromagnetic problems. 3. Understanding of electromagnetic wave propagation. 4. Ability to solve for the reflection and transmission of uniform plane waves at infinite planar interfaces. 5. Ability to evaluate transmission line problems including methods for impedance matching.	**EE468G** 1. a, k 2. a, k 3. a, k 4. a, k 5. a, c, k

	6. Ability to use commercial mathematics software for computing and visualizing electrostatic, magnetostatic and electromagnetics field problems.	6. a, k
7 and 8	**EE522 Antenna Design (3 Credit Hours)** 1. Ability to characterize the radiation properties of various antenna types. 2. Ability to decide on what antenna to choose for a given communications link scenario. 3. Ability to design various types of antennas. 4. Knowledge of methods to test antennas. 5. Ability to perform elementary antenna analysis on a computer. **EE523 Microwave Circuit Design (3 Credit Hours)** 1. Understanding of transmission line analysis and network theory. 2. Understanding of matching network design using lumped parameters or printed microstrip or strip-lines. 3. Ability to design matching networks, power dividers, couplers and hybrids using printed microstrip or strip-lines. 4. Ability to design microwave amplifiers, matching networks, and DC-Bias networks. 5. Ability to design microwave oscillators. 6. Ability to apply commercial microwave circuit design Computer Aided-Design tools. **EE525 Numerical Methods and Electromagnetics (3 Credit Hours)** 1. Ability to construct surface equivalent problems for perfectly electrically conducting scatterers and develop their electric field integral equations. 2. Ability to apply the moment method to numerically compute the electromagnetic scattering for plate geometries (quasi-static), wire geometries (quasi-static and time-harmonic), two-dimensional perfectly conducting strips (time-harmonic). 3. Ability to apply the finite difference method to compute the eigensystem for a rectangular waveguide. 4. Ability to define and design computer programs that solve the preceding problems. 5. Ability to identify and formulate the solution to a final project involving computational electromagnetics problems. 6. Ability to carry out the independent investigation and solution of the final project topic and interpret the results. 7. Ability to describe results of project in an oral presentation and a written report. **EE527 Electromagnetic Compatibility (3 Credit Hours)** 1. Understanding of the legal requirements for marketing a digital device in the United States and abroad. 2. Ability to evaluate the nonideal behavior of components at high frequencies. 3. Understanding of the relationship between the time- and frequency-domain representations of waveforms. 4. Ability to evaluate the design factors that contribute to radiated emissions, conducted emissions, and crosstalk. 5. Knowledge of basic system packaging and PCB layout factors that reduce radiated emissions, conducted emissions, and crosstalk. **EE568 Fiber Optics (3 Credit Hours)** 1. Ability to qualitatively and quantitatively describe how an electromagnetic wave can be guided by metallic and dielectric waveguides. 2. Ability to analyze the dielectric slab waveguide for the number and types of propagating modes and describe their field structure. 3. Ability to analyze the step-index round optical fiber for the number and types of propagating modes, describe the types of signal distortion, and estimate the pulse broadening due to chromatic and waveguide dispersion. 4. Ability to analyze the graded-index round optical fiber for the number of propagating modes, and qualitatively describe why varying the core index of refraction provides benefit for minimizing signal distortion. 5. Knowledge of how fiber optic cables are manufactured, common materials used, and common slicing methods. 6. Knowledge of sources and transducers used in fiber optic communication and why certain wavelength bands are preferred over others.	**EE522** 1. a, k 2. a, c, k 3. a, c, e, k 4. a, j, k 5. a, k **EE523** 1. a, k 2. a, k 3. a, c, k 4. a, c, k 5. a, c, k 6. a, c, e, k **EE525** 1. a, k 2. a, c, k 3. a, c, k 4. a, c, e ,k 5. a, c, e, k 6. a, b, c, e, k 7. g **EE527** 1. a, j, k 2. a, k 3. a, k 4. a, c, k 5. a, j, k **EE568** 1. a,k 2. a,k 3. a,k 4. a,k 5. a,j,k 6. a,j,k
8	**EE499 Electrical Engineering Design (3 Credit Hours)** 1. Ability to effectively work in groups to develop and propose engineering solutions. 2. Ability to apply previously acquired engineering principles as well as learn new principles in solving a large engineering design problem. 3. The ability communicate and thoroughly document the results of an engineering design project to the engineering community using a variety of media (report, web page)	**EE499** 1. b, d, g, k 2. a, b, c, d, i, k 3. b, g, k

Electromagnetics Courses

Semester	Microelectronics Course Sequence and Outcomes	Relationship to ABET Outcomes
5	**EE461G Introduction to Electronics (3 Credit Hours)** 1. Ability to draw the characteristic curves for the diode, BJT, JFET, and MOSFET, to identify regions of operation, and to draw the linear circuit approximations for each region.	**EE461G** 1. a, k

	2. Ability to complete a load line analysis.	2. a, k
	3. Ability to draw the circuit schematic of common rectifier circuits and draw the diode currents for the circuit with a resistive load.	3. a, k
	4. Ability to draw the circuit schematic of the common transistor amplifier configurations.	4. a, k
	5. Knowledge of advantages and disadvantages of common the transistor amplifier configurations	5. a, k
	6. Ability to bias a BJT or MOSFET device to achieve a desired quiescent operating point.	6. a, c, k
	7. Ability to linearize non-linear (transistor) devices and make small signal models.	7. a, k
	8. Ability to design and analyze simple digital circuits using diodes, BJTs or MOSFETs.	8. a, c, k
	9. Ability to cascade basic amplifiers, combine their characteristics, and compute their frequency limitations.	9. a, c, e, k
	10. Understanding of the VLSI fabrication process and the impact of standard (digital) processes on analog design.	10. k
	11. Ability to use commercial simulation tools (such as SPICE) to analyze circuits that include semiconductors.	11. a, k
6	**EE 462 Electronic Circuits Laboratory (2 Credit Hours)**	**EE462**
	1. Ability to apply real-world semiconductor characteristics in circuit analysis.	1. a, c, k
	2. Ability to perform experimental circuit analysis of electronic circuits using oscilloscopes, multimeters, function generators, and power supplies.	2. b, c, k
	3. Ability to use computer programs (HSPICE) for electronic circuit analysis.	3. a ,k
	4. Ability to describe an experimental procedure.	4. f, g
	5. Ability to interpret experimental measurements.	5. b, f, g
7 and 8	**EE560 Semiconductor Device Design (3 Credit Hours)**	**EE560**
	1. Knowledge of how semiconductor based IC's are fabricated.	1. j, k
	2. Ability to select the appropriate semiconductor for a given application.	2. a, c, k
	3. Ability to design and fabricate IC elements such as capacitors, resistors, diodes, and transistors.	3. a, c, k
	4. Knowledge of how semiconductor devices (such as negative resistance amplifiers and lasers) are designed, built, and operated.	4. j, k
	EE561 Electric And Magnetic Properties Of Materials (3 Credit Hours)	**EE561**
	1. Knowledge of fundamental electronic physical processes that determine the design and fabrication of electronic and magnetic devices including semiconductor devices, optoelectronics, solid state lasers, magnetic recording heads, and magnetism based sensors.	1. a, b, k
	2. Understanding of the relationship between models and descriptions of physical phenomena.	2. a, k
	3. Understanding of how models can change with new information or new experimental results.	3. b, i, j
	EE562 Analog Electronic Circuits (3 Credit Hours)	**EE562**
	1. Ability to construct small signal equivalent circuits that reflect the spectral region of interest.	1. a, k
	2. Ability to use SPICE in the design and analysis of analog electronic circuits.	2. a, c, e, k
	3. Understanding of the role of analog circuits in performing a variety of tasks.	3. a, k
	EE564 Digital Electronic Circuits (3 Credit Hours)	**EE564**
	1. Ability to explain the basic operation and structure of MOSFET devices.	1. a, g, k
	2. Ability to design a transistor-level MOS-based combinational logic circuit to meet the given objectives.	2. a, c, e, k 3. a, c, e, k
	3. Ability to design a transistor-level MOS-based sequential logic circuit to meet given objectives.	4. a, b, k
	4. Ability to apply computer programs to draw circuit schematics, run simulations (DCOP, DC sweep or transient), and interpret results.	5. a, g, k 6. a, j, k
	5. Ability to write a complete, concise, and organized circuit design project report.	7. a, g, j, k
	6. Ability to identify the layout considerations of integrated circuits.	8. a, c, e, k
	7. Ability to describe the primary steps in the integrated circuit fabrication process.	
	8. Ability to evaluate a MOS circuit in terms of the design considerations of static characteristics, dynamic characteristics, power, area, and fabrication complexity.	9. a, k 10. a, c, d, e, g, k
	9. Ability to calculate parameter values for MOSFET models.	
	10. Ability to work with a team to design, simulate, and report on a digital circuit design which performs to the specifications, including economic feasibility.	11. a, j, k
	11. Understanding of semiconductor industry economics in terms of yield and time-to-market of new products.	12. a, j, k 13. a, j, k
	12. Knowledge of the fundamental operation and design constraints of ROM, SRAM, and DRAM	**EE566**
	13. Understanding of the role of BiCMOS in digital circuits.	1. a, j, k
	EE566 Hybrid Microelectronics (3 Credit Hours)	2. a, c, k
	1. Understanding of relationships between processing and properties of hybrid circuit elements.	
	2. Ability to select appropriate materials and fabrication technologies to meet design specifications in engineering applications.	3. a, c, e, k **EE567**
	3. Ability to design physical layouts and processes given an electric circuit.	1. a, j
	EE 567 Introduction to Lasers and Masers (3 Credit Hours)	2. a, j
	1. Knowledge of laser types - their use, construction, and design.	
	2. Understanding of laser operation as viewed through EM fields and classical mechanics of the electron oscillator and interrelation to quantum mechanics.	3. a 4. a, c
	3. Understanding of how optical resonators, lens, and mirrors are applied to lasers.	5. a, j

	4. Ability to construct and solve rate equations.	**EE569**
	5. Knowledge of special lasers - chemical, free-electron, fiber.	1. a, i, j
	EE 569 Electronic Packaging Systems and Manufacturing Processes (3 Credit Hours)	
	1. Understanding of the relationships between manufacturing processes, design decisions, and performance of microelectronic assemblies.	2. a, c, k
	2. Ability to select appropriate assembly technologies to meet design specifications in engineering applications.	3. a, b, c, e, k
	3. Ability to apply laboratory and computer skills for designing, manufacturing, and testing surface mount circuit boards.	4. i, j
	4. Knowledge of contemporary issues associated with electronic assembly.	
8	**EE499 Electrical Engineering Design (3 Credit Hours)**	**EE499**
	1. Ability to effectively work in groups to develop and propose engineering solutions.	1. b, d, g, k
	2. Ability to apply previously acquired engineering principles as well as learn new principles in solving a large engineering design problem.	2. a, b, c, d, i, k
	3. The ability communicate and thoroughly document the results of an engineering design project to the engineering community using a variety of media (report, web page)	3. b, g, k

Microelectronics Courses

Semester	Computer Engineering Course Sequence and Outcomes	Relationship to ABET Outcomes
5	**EE380 Computer Organization and Design (3 Credit Hours)**	**EE380**
	1. Understanding of the levels of software and hardware comprising the Instruction Set Architecture of a computer.	1. a, k
	2. Ability to analytically and experimentally analyze, evaluate, and compare the performance of computers.	2. a, b, k
	3. Ability to design the assembly language instruction set of a high performance computer for a particular application environment of the computer.	3. a, e, k
	4. Understanding of how computers perform fixed and floating-point (IEEE 754 format) addition, subtraction, multiplication, and division.	4. a, k
	5. Ability to organize, design, and implement at the gate and register level the five functional units (datapath, controller, memory, input, and output) of a computer.	5. a, c, e, k
	6. Ability to make design decisions based on performance data.	6. a, b, k
	7. Ability to write and run assembly language programs on a simulator of a designed computer.	7. a, c, e, k
	EE481 Logical Design Laboratory (2 Credit Hours)	**EE481**
	1. Ability to synthesize and analyze combinatorial digital logic circuits using discrete logic circuits, proms, encoders/decoders and programmable array logic (PALs).	1. a, c, e, k
	2. Ability to synthesize and analyze sequential (synchronous and asynchronous) digital logic circuits using discrete logic circuits, proms, encoders/decoders and programmable array logic (PALs).	2. a, c, e, k 3. b, c, e, k
	3. Ability to read and understand technical specifications and apply to current design.	4. a, c, e, k
	4. Ability to formula engineering problem and to solve them using a top-down approach.	
7 and 8	**EE581 Advanced Logical Design (3 Credit Hours)**	**EE581**
	1. Understanding of fundamental and advanced uniprocessor architectural concepts and styles (register/register, register/memory, and memory/memory,etc.).	1. a, k, j
	2. Ability to design the basic building block components of computer architectural structures (decoders, multiplexors, encoders, registers, arithmetic/logic units, shifters, hardwired/microprogrammable controllers, hardware vectored priority interrupt systems, cache/RAM memory systems, etc.)	2. a, c, k 3. a, c, e, k
	3. Ability to design at the gate/register level a programmable uniprocessor computer to meet given architectural and system design specifications.	4. a, c, e, k
	4. Ability to design at the gate/register level non-programmable special purpose digital computers (finite state machines).	5. a, k
	5. Ability to verify a digital system design via simulation primarily using HDLs (VHDL and VERILOG).	**EE583** 1. a, c, e, k
	EE 583 Microprocessors (3 Credit Hours)	
	1. Ability to design the hardware of a microprocessor system which includes CPU, ROM, RAM, keyboard, displays, timer, parallel port and serial port.	2. a, c, e, k
	2. Ability to design the software of a system including laying out the memory map, system initialization and operation.	3. a, b, k **EE584**
	3. Ability to construct the system and verify it on a microprocessor development station.	1. a, j, k
	EE584 Introduction to VLSI Design and Testing (3 Credit Hours)	2. a, c, k
	1. Understanding of the VLSI fabrication process and its impact on the VLSI design process.	
	2. Ability to choose VLSI implementation media based on system level design considerations and	3. a, c, e, g, d, k

	specifications. 3. Ability to design digital CMOS VLSI devices to meet a set of system requirements and specifications (individually and as a team) and describe results in a report. 4. Understanding of the VLSI testing process and design for testability techniques. 5. Ability to use various Computer-Aided Design (CAD) tools for design capture, design verification via logic and timing simulation, and physical layout and routing. **EE585 Fault Tolerant Computing** 1. Understanding of digital testing processes and their impact on design and manufacturing processes. 2. Ability to generate test patterns for detecting specific faults and fault models in digital circuit. 3. Ability to implement design for testability techniques based on system level design considerations and specifications. 4. Understanding of error detection and correction techniques, and fault tolerant hardware design. 5. Ability to apply Computer-Aided Design (CAD) tools for design verification and fault simulation. **EE587 Microcomputer System Design** 1. Understanding of the design of a simple computer system and a simple multitasking operating system. 2. Understanding of building prototype systems, clock circuits, memory systems, I/O devices and serial interfaces. 3. Knowledge of context switching and scheduling policies in operating systems, data structures for operating systems, interrupt handling, and device control on an operating system.	4. a, j, k 5. a, b, k **EE585** 1. a, k 2. a, c, k 3. a, c, e, k 4. a, j, k 5. a, b, k **EE587** 1. a, k 2. a, k 3. a, j, k
8	**EE499 Electrical Engineering Design (3 Credit Hours)** 1. Ability to effectively work in groups to develop and propose engineering solutions. 2. Ability to apply previously acquired engineering principles as well as learn new principles in solving a large engineering design problem. 3. The ability communicate and thoroughly document the results of an engineering design project to the engineering community using a variety of media (report, web page).	**EE499** 1. b, d, g, k 2. a, b, c, d, i, k 3. b, g, k

Computer Engineering Courses