ECE 148. Analysis and Design of Digital Circuits (3)
Prerequisites: ECE 85, 128. Analysis and design of solid state digital circuits utilizing various logic families suitable for integration: TTL, ECL, NMOS, CMOS; logic gates; multivibrators; ROM, PROM, EPROM, and EEPROM; SRAM and DRAM.

ECE 151. Electrical Power Systems (3)
Prerequisites: ECE 90. Power system networks and equipment, power flow, symmetrical components, short circuit analysis, introduction to economic dispatching and stability analysis, applications and use of software in power system analysis.

ECE 152. Power Systems Protection and Control (3)
Prerequisites: ECE 151 and 155 or concurrently. Transmission and distribution systems, protection and coordination, stability analysis, voltage and frequency control, system modeling, and computer simulation.

ECE 153. Power Electronics (3)
Prerequisites: ECE 124 and ECE 128. Analysis and design of power conversion devices, AC-DC converters (diode rectification and phase control devices), DC-DC converters (Buck/Boost), DC-AC inverters; continuous and discontinuous modes of operation, performance evaluation, power factor correction, signal distortion, efficiency analysis, applications, and hands-on experiences. (Formerly ECE 191T)

ECE 155. Control Systems (3)
Prerequisites: ECE 124. Analysis, design, and synthesis of linear feedback control systems. Mathematical modeling and performance evaluation. Frequency domain analysis and design methodologies. Applications and utilization of Matlab in analysis and design.

ECE 162. Analog Integrated Circuits and Applications (3)
Prerequisite: ECE 138. Analysis of monolithic operational amplifiers; case studies; Widlar and Wilson current sources; linear and nonlinear applications; multipliers, phase-lock loops, phase detectors; higher order active filters; all-pass equalizers; D/A and A/D converters; oscillators, function generators; mixers, modulators, regulators; system design.

ECE 166. Microwave Devices and Circuits Design (3)
Prerequisite: ECE 136. Microwave theory and techniques: slow-wave structures, S parameters, and microwave devices, including solid-state devices such as Gunn, IMPATT, TRAPATT, and BARITT diodes, and vacuum tubes such as klystrons, reflex klystrons, traveling-wave tubes, magnetrons and gyrotrons.

ECE 168. Microwave Amplifier and Oscillator Design (3)
Prerequisite: ECE 136. Small-signal and large-signal amplifier designs such as high-gain, high-power, low-noise, narrow-band and broadband amplifiers; microwave oscillator designs such as high-power, broadband, Gunndiode and IMPATT oscillator designs; power combining and dividing techniques; reflection amplifier design and microwave measurements.

ECE 171. Quantum Electronics (3)
Prerequisite: ECE 126. Review of wave properties; cavity mode theory; radiation laws; theory and morphology of lasers; laser and fiber-optic communications; designs of optical communication systems and components.

ECE 172. Sequential Machine and Automata Theory (3)
Prerequisite: ECE 106. Structure of sequential machines with particular emphasis on asynchronous sequential machines; covers; partitions; decompositions and synthesis of multiple machines race conditions and hazards; state identification and fault detection experiments. Presents design techniques aimed at circuit performance that will function reliably with less than ideal components. Applications include the design of controllers for robots and automated machines.

ECE 173. Robotics Fundamentals (3)
Prerequisites: ECE 70/71 or CSCI 40; ECE 90/90L and ECE 85/85L or 91/91L; MATH 77. Introduction to industrial and mobile robots, forward and inverse kinematics, trajectory planning, sensors, micro controllers, and laboratory experiments.

ECE 174. Advanced Computer Architecture (3)
Prerequisites: ECE 115 or 118. Advanced computing architecture concepts; pipelining; multiprocessing and multiprogramming; cache and virtual memory; direct memory access, local and system bus architectures; instruction set design and coding; CPU and system performance analysis.

ECE 176. Computer-Aided Engineering in Digital Design (3)
Prerequisites: ECE 120L or concurrently. Use of Computer-Aided Engineering tools in the design and implementation of digital systems utilizing Applications Specific Integrated Circuits. Design projects from specification through implementation using Field Programmable Gate Arrays (FPGAs) and Complex Programmable Logic Devices (CPLDs); simulation, timing analysis, Hardware Definition Languages. Hands-on exposure to current tools.

ECE 178. Embedded Systems (4)
Prerequisites: ECE 120L, ECE 176. Principles of real-time computing embedded systems, hardware/software peripherals interface, design applications using RISC processors, and real-time operating system and project activities.

ECE 186A. Senior Design I (1)
Prerequisites: 30 units of ECE (*see advising notes*) or permission of instructor; university writing requirement or concurrently. Design projects in electrical and computer engineering.

ECE 186B. Senior Design II (3)
Prerequisite: ECE 186A and university writing requirement. Completion of approved design projects in electrical and computer engineering. Project demonstration and documentation requires using problem solving, written communication, and critical thinking skills, as well as engaging in oral presentations.

ECE 190. Independent Study (1-3; max total 6)
See *Academic Placement — Independent Study.* Approved for ***RP*** grading.

ECE 191T. Topics in Electrical and Computer Engineering (1-3; max total 6)
Prerequisite: permission of instructor. Investigation of selected electrical engineering subjects not in current courses.

ECE 193. Electrical and Computer Engineering Cooperative Internship (1-6; max 12)
Prerequisite: permission of adviser. Engineering practice in an industrial or governmental installation over a period of about seven months' duration. Each period must span a summer-fall or spring-summer interval. This course cannot be used to meet graduation requirements. ***CR/NC*** grading only.