1521. Basic Digital and Computer Circuits. Introduction to digital and computer design concepts: number systems, switching algebra, logic gates, and truth tables. Combinational and sequential design techniques. Comparators, multiplexers, coders and decoders, flip-flops, registers, counters, and their practical applications. 3 s.h.

1521L. Basic Digital and Computer Circuits Laboratory. Laboratory exercises to accompany ECEN 1521. Design and testing of combinational and sequential logic circuits. Experiments with computer hardware. Prereq. or concurrent: ECEN 1521. 1 s.h.

1555. Computer Engineering. Introduction to the personal computer, applications software, technologies, microprocessors, microcomputer programming and applications. Basic operation of digital circuits, interfacing using integrated chips, and analog computers. Experiments accompany lectures, providing practical experience for students. 3 s.h.

1555H. Honors Computer Engineering. The personal computer, its components, and the role it plays in control applications, instrumentation, and engineering design. Basic experiments using digital circuits, microcomputers, integrated circuits, and design software integrated into a project with the personal computer and instrumentation. Prereq. or concurrent: ENGL 1550H and admission to the Honors Program or permission of instructor and Director of Honors. 3 s.h.

1560. Electrical Engineering Computing. Problem solving techniques for the fields of electrical and computer engineering; procedural program development using the C/C++ programming language. Fundamentals of engineering drawing using AutoCAD commercial software packages. One hour lecture, three hours lab. Prereq.: MATH 1571 or concurrent, high school technical drawing proficiency or ENGR 1555. ENGR 1555 may be taken concurrently. 2 s.h.

2610. Computer Tools for Electrical and Computer Engineering. Introduction to software packages and resources such as MATLAB, PSpice, and Quartus II for analysis and design of circuits and systems. Prereq. or concurrent: ECEN 2632 and ECEN 2611. 1 s.h.

2611. Instrumentation and Computation Lab 1. Laboratory experiments and computer exercises to accompany ECEN 2632. Laboratory experimentation and basic instrumentation. Computer-aided analysis and simulation. Prereq. or concurrent: ECEN 2632. 1 s.h.

2612. Instrumentation and Computation Lab 2. Laboratory experiments and computer exercises to accompany ECEN 2633. Laboratory experimentation and basic instrumentation. Computer-aided analysis and simulation. Prereq.: ECEN 2611. Prereq. or concurrent: ECEN 2633. 1 s.h.

2614. Basics of Electrical Engineering. Introduction to electrical circuit elements and laws; DC and AC analysis. Introduction to digital devices and circuits with applications. Applications of electromagnetics. Intended for non-electrical engineering majors. Prereq. MATH 1571. 3 s.h.

circuits using phasors; impedance and admittance. Power calculations in DC and AC circuits. Prereq. or concurrent: MATH 1572.


3710. Signals and Systems. Operation and analysis of communication, control, and computer systems at the signal level. Computer aided design tools and methods to analyze signals and systems. Continuous and discrete-time transforms. Noise analysis, signal detections, line codes, and multiplexing. Prereq.: ECEN 2633, ECEN 1521, and MATH 3705.

3711. Intermediate Laboratory 1. Laboratory experiments and computer exercises in the areas of digital and analog electronics and logic and computer circuits. Designed to accompany the co-requisite courses. Prereq.: ECEN 2612. Prereq. or concurrent: ECEN 3733 and 3771.

3712. Intermediate Laboratory 2. Laboratory experiments and computer exercises in the areas of digital and analog electronics, logic and computer circuits, and electromagnetics. Designed to accompany the co-requisite courses. Prereq.: ECEN 3711. Prereq. or concurrent: ECEN 3742 and either ECEN 3772 or 3734.

3717. Sensor Fundamentals. Basic principles of sensors such as electro-chemical, -mechanical, -optical, and -thermal transducers. Signal conditioning and smart sensors. Applications in process control and environmental systems. Prereq.: MATH 3705; and either PHYS 2611 or ECEN 2632.

3730. Microprocessors and Microcontrollers. Organization and structured assembly language programming. Digital controller devices and their relationships to processors and physical environments. Two hours lecture and three hours laboratory per week. Prereq.: ECEN 3733.


3771. *Digital and Analog Circuits 1.* Terminal characteristics of electronic devices such as diodes, BJTs (bipolar junction transistors), FETs (field-effect transistors), and operational amplifiers. The design of digital circuits with these devices. Basic bias and small-signal models for analog amplifiers. Computer-aided design and analysis. Prereq.: ECEN 2633. 3 s.h.

3772. *Digital and Analog Circuits 2.* Continuation of ECEN 3771. Bias and signal modeling for amplifier design. Large-signal, small-signal and DC amplifiers. Single-stage, multi-stage and power amplifiers. Frequency response. Applications with op amps such as amplifiers, comparators, filters, and oscillators. Computer-aided design and analysis. Prereq.: ECEN 3771. 3 s.h.

4803/4803L. *Linear Control Systems.* System modeling, responses and performance measures. Stability analysis by root locus, Bode, and Nyquist plots. Computer-aided control system design. Compensator design. Three hours lecture, three hours laboratory per week. Prereq.: ECEN 2633, 3712, MATH 3705, MECH 2620. 4 s.h.+0 s.h.

4811. *Senior Laboratory.* Laboratory experiments and computer exercises in the areas of applied electromagnetics and energy conversion. Designed to accompany the co-requisite course. Prereq.: ECEN 3712. Prereq. or concurrent: ECEN 4844. 1 s.h.

4844. *Electromagnetic Energy Conversion.* An examination of lumped electromagnetic parameters with development of theoretical, experimental, and design parameters for electrical energy conversion devices such as transformers, motors, and generators. Typical and special applications. Prereq.: ECEN 3741. Prereq. or concurrent: MECH 2620. 3 s.h.

4851. *VLSI System Design.* Basic MOSFET models. Layout of inverters, NAND, NOR, PLA, PAL and ROMs. CMOS process and design rules. VLSI system design methodology and computer EDA tools such as PSpice and layout editors. Prereq.: ECEN 3771, ECEN 3733. 3 s.h.

4852. *Neural Networks and Robotics.* Principles for control applications and robotics, direct inverse control, neural networks, and fuzzy set theory. Applications including adaptive control, neural networks for motion control and path planning in robotics. Prereq.: ECEN 3733. 3 s.h.


4856. *Embedded System Design.* Fundamentals of small-scale and medium-scale embedded systems. Design techniques for processors, timers, input device interfacing, interrupt controllers, and drive circuits. Real-time operating system programming tools. Hardware-software co-designs. Three hours lecture, three hours laboratory. Prereq.: ECEN 3733. 4 s.h.
4881. *Modern Control System Design.* State variable techniques for continuous-time and discrete-time systems. Introduction to system identification. Pole placement using state-variable feedback. Design of state observers. Digital computer implementation of controllers. Three hours lecture, three hours laboratory per week. Prereq.: ECEN 4803. 4 s.h.

4899. *Senior Design Project.* An electrical/computer engineering design problem is chosen or assigned; students work in teams. Proposals are presented which describe the design problem and approaches to it. The final design is presented in written and oral forms. This capstone course is intended to mimic a typical industrial or research project and includes ethical and economical considerations with the engineering work. Three hours of lecture/discussion, three hours of laboratory per week. Prereq: ECEN 4811 and 27 s.h. of ECEN courses. 4 s.h.

5800. *Special Topics.* Special topics, new developments in Electrical Engineering. Subject matter, special prerequisites, and credit hours to be announced in advance of each offering. May be repeated with different subject matter to a maximum of six credit hours. Prereq.: Senior standing in Electrical and Computer Engineering. 1-3 s.h.

5807. *Advanced Digital and Analog Circuits.* Chip circuitry for devices such as BJT, CMOS, and ECL-based digital logic chips. Switching devices such as SCRs, triacs, and timers. Switching power supplies. Power amplifiers. Applications and specifications of off-the-shelf IC devices. Computer-aided design and analysis. Prereq.: ECEN 3772. 3 s.h.

5808. *Advanced Signals and Systems.* Communication and control system modeling and simulations; signal analysis in continuous-time, discrete-time and frequency domains. Advanced communication system applications. Prereq.: ECEN 3710 and MATH 3705. 3 s.h.

5816. *Theory and Fabrication of Solid-State Devices.* An introductory study of physical theory, design, and fabrication of discrete devices and integrated circuits. Electronic properties of semiconductors such as carrier concentration, energy gap, mobility, lifetime. Techniques of fabrication such as oxidation, diffusion, alloying, ion implantation, metallization, masking. Prereq.: ECEN 3741 and ECEN 3771. 3 s.h.

5817. *Sensor Design and Application.* Designs and applications for measurement and control; includes electro-chemical, -mechanical, -optical, and -thermal transducers. Signal conditioning and smart sensors. Prereq.: ECEN 3711 or ECEN 3717. 3 s.h.

5830. *Digital Signal Processing.* Discrete time signals and systems; discrete, fast, and inverse Fourier transforms. Digital filter analysis and design, digital signal processing applications. Two hours lecture, three hours laboratory. Prereq.: ECEN 3710. 3 s.h.

5835. *Computer Architecture with VHDL.* Use of hardware description languages to design computer components and systems. Arithmetic and logic units, control units, VHDL models for memories and busses, interfacing, transfer design. Survey of modern computer systems. Prereq.: ECEN 3734. 4 s.h.
5840. *Electric Power Systems*. Modeling of power system components. Power flow, faults, protection systems, and stability problems. Special projects and laboratory experiments including CAD application for analysis, design, and simulation of power system networks. Three hours lecture, three hours laboratory per week. Prereq. or concurrent: ECEN 4844. 4 s.h.

5850. *Communications Applications*. Applicable technologies and “real-world” communication components and systems. Design and analysis tools. Emerging technologies, “killer apps,” networking, data acquisition, and convergence. Prereq.: ECEN 3710 or 5808. 3 s.h.

5860. *Energy Radiation and Propagation*. Examination of dipole, loop aperture, reflector, lens, surface wave, traveling wave, and other antennas; array theory; radiation resistance, directivity, and input impedance. Investigation of theoretical and practical applications of fiber optics. Prereq: ECEN 3742 and 21 s.h. of ECEN courses. 3 s.h.

5879. *Computer-Aided Design*. The design, analysis, and modeling of linear and nonlinear networks and systems using a simulation and modeling computer program. Development and use of library models of devices, subcircuits, and subsystems. Prereq.: ECEN 2611 and 21 s.h. of ECEN courses. 3 s.h.

5890. *Power Electronics*. SCRs, rectifier circuits, commutation techniques, AC controllers, converters, and inverters. Special projects and laboratory experiments including computer applications for analysis, design, and simulation of power electronics networks. Three hours lecture, three hours laboratory per week. Prereq.: ECEN 3771 and 21 s.h. of ECEN courses. 4 s.h.

6900. *Seminar*. May be repeated once. 1-3 s.h.


6911, 6912. *Electromagnetic Fields 1 and 2*. Solution of boundary value problems in general form. Laplace, Poisson, and diffusion and wave equations in orthogonal coordinate systems. 3+3 s.h.

6933. *Digital Systems: VHDL Design*. Local minimization, design of combinational networks; design of synchronous and asynchronous sequential machines; design of digital systems using VHDL, modeling combinational and sequential networks, compilation, simulation, and synthesis of VHDL codes. 3 s.h.

6981. *Electric Power System Engineering.* The formulation of equations to study electric power network problems, including feeders, power flow, short circuits, protection systems, and stability. The study of power system over-voltages and transients caused by short circuits, switching, and lightning. The application of numerical techniques to study and design special projects using digital computations. 3 s.h.

6983. *Modern Power Sources.* Analytical and descriptive study of modern power plants. Combustion and environmental problems with fossil-fueled power plants. Electromagnetic circuits and devices with emphasis on the principles of electromechanical energy conversions. Cross listed with CHEGR 6983 and MECH 6983. 3 s.h.

6985. *Electromechanical Motion Devices.* Thermodynamics of batteries, and of electric and fuel cells. Power from nuclear isotopes. Features common to rotating electromagnetic fields. Analysis and design of electromechanical power components. Logic circuit design with I/O structure and interface. Cross listed with CHEGR 6985 and MECH 6985. 3 s.h.

6986. *Power Electronics Circuits and Devices.* The design and analysis of power electronic circuits using solid-state switching devices. Topics include power semiconductor diodes and transistors, diode circuits and controlled rectifiers, thyristors, communication techniques, AC voltage controllers, and switching regulators, with applications. 3 s.h.

6987. *Power Electronics and Industrial Drives.* The design and analysis of power electronic circuits and systems; static switches, power supplies, AC and DC drives, and protection of power electronic devices and circuits. 3 s.h.

6990. *Thesis.* 1-6 s.h.