# Dept. of Electrical & Computer Engineering
## ECEGR Courses

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 ECEGR 1521. Design and testing of combinational and sequential logic circuits. Experiments with computer hardware. Prereq. or concurrent: ECEGR 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.

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: ECEGR 2632 and ECEGR 2611. 1 s.h.

2611. *Instrumentation and Computation Lab 1.* Laboratory experiments and computer exercises to accompany ECEGR 2632. Laboratory experimentation and basic instrumentation. Computer-aided analysis and simulation. Prereq.: ENGR 1560 or CSIS 2610. Prereq. or concurrent: ENGL 1551 and ECEGR 2632. 1 s.h.

2612. *Instrumentation and Computation Lab 2.* Laboratory experiments and computer exercises to accompany ECEGR 2633. Laboratory experimentation and basic instrumentation. Computer-aided analysis and simulation.
Prereq.: ECEGR 2611 and ENGL 1551. Prereq. or concurrent: ECEGR 2633. 1 s.h.

2632. *Basic Circuit Theory 1*. Basic principles of linear circuits. Circuits concepts and laws, methods of analysis, network theorems. Source-resistor circuits. Inductors and capacitors. First-order transients. Analysis of AC circuits using phasors; impedance and admittance. Power calculations in DC and AC circuits. Prereq. or concurrent: MATH 1572. 3 s.h.

2633. *Basic Circuit Theory 2*. Continuation of ECEGR 2632. Transients in RLC circuits. Mutual inductance and transformers. Three-phase circuits. Transform methods in circuit analysis, transfer functions, resonance. Prereq. or concurrent: MATH 2673. Prereq.: ECEGR 2632. 3 s.h.

3709. *Communications Systems.* Digital and analog signals, communication systems. Signal characteristics, generation, transmission, and reception. Time and frequency domain transforms. Digital and analog modulation techniques such as pulse, amplitude, and frequency. Pulse and line coding. Sampling, quantizing, and multiplexing. Applications and emerging technologies.
Prereq: ECEGR 2633, MATH 3705, and PHYS 2611. 3 s.h.

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 Fourier transforms. Noise analysis, signal detections, line codes, and multiplexing. Prereq.: ECEGR 2633 and ECEGR 1521. 3 s.h.

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.: ECEGR 2612. Prereq. or concurrent: ECEGR 3731 and 3771. 1 s.h.

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.: ECEGR 3711. Prereq. or concurrent: ECEGR 3742; ECEGR 3772 or 3732. 1 s.h.

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 ECEGR 2632. 3 s.h.

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.: ECEGR 3731. 3 s.h.

3731, 3732. *Digital Systems 1, 2.* Analysis, design, and application of logic arrays, basic cells, flip-flops, registers, counters, memories, and controllers. Synchronous and asynchronous finite-state machines. Analysis and design of systems using programmable logic arrays, programmable logic controllers, and microprocessors.
Prereq: ECEGR 1521, 1521L, 2632 for 3731; 3731 for 3732. 3 + 3 s.h.

3741. *Electromagnetic Fields 1.* Maxwell's equations. Static electric and magnetic fields. Magnetic materials and forces, dielectrics, conductance, capacitance, and inductance. Poisson's and Laplace's equations. Prereq.: ECEGR 2632, PHYS 2611, MATH 3705. 3 s.h.

3742. *Electromagnetic Fields 2.* Maxwell's equations. Time varying electric and magnetic fields. Electro-mechanical devices, transmission lines, microwaves. Antennas and radiation.
Prereq.: ECEGR 3741. 3 s.h.

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.: ECEGR 2633. 3 s.h.

3772. *Digital and Analog Circuits 2.* Continuation of ECEGR 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.: ECEGR 3771. 3 s.h.

4803/4803L. *Linear Control Systems*. Laplace transform techniques and system modeling. System responses and performance measures. Root locus analysis and design. Frequency response methods: Bode plots, Nyquist criterion, stability margins. Computer-aided control system design. Control design and implementation. Two hours lecture, three hours laboratory per week.
Prereq.: ECEGR 2633, 3712, MATH 3705, MECH 2641. 3 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.: ECEGR 3712. Prereq. or concurrent: ECEGR 4844. 1 s.h.

4824. *Digital Design with Microprocessors.* Principles and applications of microprocessors. Hardware architecture, assembly language, programming and interfacing. Two hours lecture, three hours laboratory. Prereq.: ECEGR 3732, 3712. 3 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.: MECH 2641, ECEGR 3741 and 21 s.h. of ECEGR courses. 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 including PSpice and layout editors. Prereq.: ECEGR 3771, ECEGR 3731. 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.: ECEGR 3730. 3 s.h.

4854. *Principles of Electromagnetic Compatibility*. Review of electromagnetic theories. Techniques of electromagnetic compatibility in electronic systems and computer hardware. Modeling and simulation of transmission lines and circuits. Electromagnetic discharge and grounding problems for high-frequency applications. Radio-frequency emissions from electronic devices. Shielding techniques to prevent ESD and EMI. Prereq.: PHYS 2611, MATH 3705. 3 s.h.

4855. *Advanced Digital Control*. Fundamentals of sampled linear control systems, digital controllers and observers. Analysis techniques including difference and state-variable equations, transfer functions, transforms. Sampling, stability, and discrete approximation. Prereq.: ECEGR 3730. 3 s.h.

4856. *Embedded Systems*. Fundamentals of smallscale 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.
Prereq.: ECEGR 3730. 3 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.: ECEGR 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: ECEGR 4811 and 27 s.h. of ECEGR 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.: ECEGR 3772. 3 s.h.

5808. *Signals and Systems.* Operation and analysis of communications, control, and computer systems at the signal level. Tools and methods used to analyze signals and design systems. Probabilities, statistics, and noise. Signal detection, line codes, and multiplexing. Applications. Prereq.: ECEGR 3709, or ECEGR 2633 and MATH 3705 and PHYS 2611. 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.: ECEGR 2633, PHYS 2610, ECEGR 3741. 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.: ECEGR 3771 or ECEGR 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.: ECEGR 3711 and either ECEGR 3709 or 3732. 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.: ECEGR 3732. 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: ECEGR 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. Individual and team design projects. Prereq.: ECEGR 3709 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: ECEGR 3741 and 21 s.h. of ECEGR 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.: ECEGR 2611 and 21 s.h. of ECEGR 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.: ECEGR 3771 and 21 s.h. of ECEGR courses. 4 s.h.

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

6901. *Control Systems 1.* Fundamental concepts in linear system theory; matrix algebra, linear vector spaces, linear operators. Input-output and state-space models for continuous-time systems; canonical forms. Solutions of state space equations. Characteristics of linear systems: stability; controllability and observability. State variable feedback, introduction to state estimation. 3 s.h.

6902. *Control Systems 2.* State-variable feedback techniques; design of state estimators. Design using polynomial equations. Design of digital controllers: discrete equivalents and direct methods. Introduction to implementation of digital control systems. Prereq.: ECEGR 6901. 3 s.h.

6903. *Advanced Control Systems.* Introduction to nonlinear control systems: basic nonlinear phenomena, describing functions, Lyapunov stability, linearization techniques. Introduction to linear optimal quadratic control; stochastic modeling and Kalman filtering. Prereq.: ECEGR 6902. 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 VHD, modeling combinational and sequential networks, compilation, simulation, and synthesis of VHDL codes. 3 s.h.

6934. *Digital Systems: Computer Arithmetic*. Number system representations: standard and unconventional formats. Design of two-operand and multi-operand fast adders. High-speed multiplication and division algorithms. Floating-point numbers, algorithms, and error control. Hardware algorithms for function evaluation. Prereq: ECEGR 6933. 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.