

Electrical Engineering

College of Engineering

The Department of Electrical and Computer Engineering offers advanced studies leading to either a Master of Science in Electrical Engineering or a Doctor of Philosophy in Electrical Engineering.

Admission Requirements

A minimum grade point average of 3.0/4.0 on all undergraduate work is required for admission to the graduate program. A minimum GRE general test scores of 301 (combination of Verbal and Quantitative sections) and analytical writing of at least 2.5 for the M.S. degree. The corresponding minimum GRE scores for Ph.D degree are 310 (V+Q) and 3.0 (Writing). Meeting the minimum requirements does not guarantee admission will be granted. Acceptance is based upon a competitive evaluation and on a space-availability basis. An undergraduate degree in electrical engineering is preferred. Those applicants without a B.S.E.E. degree from an ABET accredited EE program should develop competence and demonstrate ability in the fundamentals of electrical engineering. Such students, before being admitted to full graduate standing within the department, must take (or have taken an equivalent of) a set of prescribed electrical engineering remedial courses. A minimum grade of C must be made in these courses.

Degree Requirements

For the M.S.E.E. degree, both the thesis and non-thesis options are available. The thesis option requires 24 hours of acceptable graduate level work plus the satisfying of the usual requirements for the thesis. The non-thesis option, Plan B, requires 30 hours of acceptable graduate work plus an additional three hours of EE 784 (Research Project in Electrical Engineering). All students in their first semester of regular graduate work must select an academic advisor who will assist the student in formulating a graduate plan of study leading to their particular degree. This plan, which must receive the approval of the Director of Graduate Studies, must contain specific courses and a proposed thesis area or specialized project topic.

For the PhD degree, students who only have a B.S. degree must complete 42 hours of course work. Students who have a M.S. degree from an accredited institution must complete 18 hours of course work. Students who have a M.S. degree from a non accredited institution must complete 24 hours of course work.

In order to assure a minimum breadth and level of understanding at the graduate level, all EE graduate students must take three of six specified courses from the major areas of electrical engineering. These courses are: EE 611 Deterministic Systems, EE 621 Electromagnetic Systems, EE 640 Stochastic Systems, EE641 Advanced Power Systems, EE 661 Solid State Electronics, EE 685 Digital Computer Structure. PhD students must also take a course in technical writing such as WRD 204.

The Department of Electrical and Computer Engineering has active research programs in the following areas: power electronics, power systems, electromechanics, computer engineering, control systems, electromagnetics, electro-optics, micro and nano-electronics, signal processing, communication systems, and controls. Departmental laboratories are well-equipped for students' research. In addition, the Power and Energy Institute of Kentucky provides additional research opportunities.

Course Descriptions

EE 503 POWER ELECTRONICS. (3)

Study of solid-state power electronic devices and their applications. Examination of control philosophies, steady-state models, and numerical simulation of characterizing differential equations. Current topics of

interest from the literature. Prereq: EE 415G and EE 461 or consent of instructor.

EE 511 INTRODUCTION TO COMMUNICATION SYSTEMS. (3)

An introduction to the basic signal processing operations in communications systems. Topics include frequency and time domain signal and system representation, random signals, modulation, sampling, pulse modulation, information theory. Prereq: EE 421G, MA 320, and engineering standing.

EE 512 DIGITAL COMMUNICATION SYSTEMS. (3)

A treatment of the basic signaling concepts involved in the communication of digital information. Topics include transmission requirements and distortion of digital signals; discrete amplitude, frequency, and phase modulation; error control coding. Prereq: EE 421G, EE 422G, engineering standing or consent of instructor.

EE 513 AUDIO SIGNALS AND SYSTEMS. (3)

An introduction to digital signal processing and classification methods for audio signals. Topics include signal analysis and system design using correlation functions, power spectra, difference equations, and transfer functions; implementations of filters, classifiers, and audio effects; characteristics and modeling of common audio signals such as speech, music, and noise. Prereq: EE 422G, engineering standing.

EE 517 ADVANCED ELECTROMECHANICS. (3)

Dynamics of electromechanical systems and rotating electrical machines. Applications of electro-magnetic theory to electrical machines. Certain special topics of current interest. Prereq: EE 415G, EE 421G, and engineering standing.

EE 518 ELECTRIC DRIVES. (3)

Introduction to common power electronic converters used in electric motor drives. Steady-state analysis methods for electric machines fed by power conditioning converters. Performance prediction of electric machines by electromagnetic field theory and by coupled oil models. Prereq: EE 415G, EE 421G, and engineering standing.

EE 521 INTRODUCTION TO WIRELESS COMMUNICATIONS. (3)

Study of analog RF electronics for wireless communications through a combination of course and laboratory work. Topics covered in the course include: modulation/demodulation, filters, RF transformers, mixers, transistor switches and amplifiers, class A, B, AB, C, D, E, and F amplifiers, quartz crystals, transmission lines, impedance inverters, acoustics, oscillators, audio circuitry, noise and inter-modulation, and antennas. Prereq: Engineering standing.

EE 522 ANTENNA DESIGN. (3)

Principles of radiation, potential solution to Maxwell's equations for current in empty space, electrically small antennas, antenna arrays, wire antenna principles, introduction to numerical methods, aperture antennas, frequency scaling antennas, receiving properties of antennas, antenna measurement techniques. Prereq: EE 468G and engineering standing.

EE 523 MICROWAVE CIRCUIT DESIGN. (3)

Physical and mathematical descriptions of wave propagation in guided structures; microstrip lines; microwave integrated circuits; passive components; two-terminal devices; four-terminal devices; S-parameter concept; equivalent circuit concept; solid state microwave amplifiers and oscillators. Prereq: EE 468G and engineering standing.

EE 524 SOLID STATE PHYSICS. (3)

Introductory solid state physics with emphasis on the properties of electrons in crystals; crystal structure, crystal diffraction, reciprocal lattice, lattice vibrations and phonons, free electron theory, energy bands in solids, semiconductors. Prereq: PHY 520, or consent of instructor. Engineering standing required for EE 524. (Same as PHY 524.)

EE 525 NUMERICAL METHODS AND ELECTROMAGNETICS. (3)

This course covers the basics of numerical methods and programming with applications in electromagnetics. Examples range from statics to radiation/scattering problems involving numerical solutions to integro-differential and finite difference equations. Prereq: EE 468G and engineering standing, or consent of instructor.

EE 526 LEAN OPERATIONS MANAGEMENT. (3)

This course will cover topics in basic lean system operations as well as the management system to support the attainment of highest customer satisfaction with respect to Safety, Quality, Cost, Productivity, Delivery and Human Resource Development. Working in teams, students apply fundamental lean tools and concepts to develop a lean operations environment capable of driving continuous improvement in a simulated factory. As the operational environment evolves, key management principles and tools are explored using the teachings of Taiichi Ohno and others considered to be the pillars of the Toyota Production System. All students must have a webcam and microphone or headset to participate in on-line team and class meetings. Prereq: Enrollment restricted to junior-level or above students. Prior enrollment in the Lean Student certificate course or MFS 503 is required or with the consent of the instructor. (Same as ME 526/MFS 526.)

EE 527 ELECTROMAGNETIC COMPATIBILITY. (3)

Design of electronic systems to minimize 1) emission of electromagnetic signals that cause interference in other electronic systems, 2) the susceptibility of that system to electromagnetic signal from other electronic systems, and 3) the susceptibility of that system to its own, internally generated signals. A set of brief laboratory experiments demonstrate the design principles and provide familiarity with modern test equipment. Prereq: EE 468G and engineering standing.

EE 528 AUTOMOTIVE BODY WELDING. (3)

The objective of this course is to introduce students to automotive Body Production Engineering (BPE). The course will introduce students to the joining methods to produce subassemblies and the main body assembly. The course will cover joining methods, joining theory, quality assessment, and design of experiment to prove welding joints. Prereq: Engineering Standing and enrollment in the Production Engineering Certificate.

EE 531 ALTERNATIVE AND RENEWABLE ENERGY SYSTEMS. (3)

Study of non-traditional, electric generating systems, and the use of renewable energy sources. Energy sources include solar, wind, hydro, and biomass/biogas. Generating technologies include both inverter based equipment and rotating machinery. Prereq: EE 415G, Engineering Standing or consent of instructor.

EE 532 SMART GRID: AUTOMATION AND CONTROL OF POWER SYSTEMS. (3)

This course covers introduction to smart grid, key technologies in transmission and distribution systems that enable smart grid, power market structure, and real time pricing. Prereq: Engineering standing, or consent of instructor.

EE 533 ADVANCED POWER SYSTEM PROTECTION. (3)

This course teaches philosophies for protecting power systems, covers micro-processor based relays, and provides projects on relay setting and relay testing. Prereq: Engineering standing, or consent of instructor.

EE 535 POWER SYSTEMS: GENERATION, OPERATION AND CONTROL. (3)

This course covers essential aspects of the energy management system of power systems. Will cover topics: power system economics, state estimation, power system stability, power quality, and fault location. Prereq: EE 537 or concurrent, and Engineering Standing.

EE 536 POWER SYSTEM FAULT ANALYSIS AND PROTECTION. (3)

This course teaches computer based methods for performing fault analysis of power systems, and principles for protecting power systems.

***EE 537 ELECTRIC POWER SYSTEMS I. (3)**

A study of power flow, elements of power factor correction, the one-line diagram, the per-unit system, transformer modeling, generator modeling, transmission line modeling, transmission line performance calculations from equivalent circuits, and general methods for network calculations. Prereq: Engineering standing, or consent of instructor.

EE 538 ELECTRIC POWER SYSTEMS II. (3)

Introduction to modern power system practices, basic transient and steady-state stability analysis with emphasis on digital techniques. Prereq: Engineering standing and consent of instructor.

EE 539 POWER DISTRIBUTION SYSTEMS. (3)

Study of electric utility distribution power systems. Topics include configurations, equipment, customer class data, load flow, phase balancing, capacitor placement, system protection, power quality, and distributed generation. Prereq: EE 537, engineering standing or consent of instructor.

EE 543 SOLAR CELL DEVICES AND SYSTEMS FOR ELECTRICAL ENERGY GENERATION. (3)

Physics of photovoltaic (PV) devices, emerging technologies, design of PV cells and systems, electronic components for signal conditioning, integration, installation, performance evaluation and economic issues related to PV systems. Prereq: EE 211 or EE 305 and Engineering Standing, or consent of instructor. (Same as BAE 543/EGR 543.)

EE 546 ELECTRIC POWER SYSTEM FUNDAMENTALS. (3)

Introduction to power transmission basics, power system components, power flow, fault analysis and protection, control, stability, and economic operation of the power grid. This course will also introduce modern trends such as distributed generation, communications, and cybersecurity. Prereq: Graduate or engineering standing and EE 221, EE 305, or equivalent. (Same as EGR 546.)

EE 555 INTRODUCTION TO MICRO-/NANO-ELECTROMECHANICAL SYSTEMS. (3)

This course provides an overview of micromachined structures with an emphasis on operational theory and fabrication technology. Prereq: Engineering standing or consent of instructor. (Same as ME/MSE 555.)
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EE 560 SEMICONDUCTOR DEVICE DESIGN. (3)

Theory, development and discussion of equivalent circuit models of transistor devices, negative resistance, semiconductor devices and praetersonic devices based on electronic processes in solid state elements. High and low frequency, as well as the Ebers-Moll and charge control switching models and their application in computerized electronic circuit analysis will be developed. Prereq: EE 461G or equivalent, and engineering standing.

EE 562 ANALOG ELECTRONIC CIRCUITS. (3)

Feedback amplifiers, tuned and untuned amplifiers, oscillators, AM and FM transmitters. Prereq: EE 360, EE 461G and engineering standing.

EE 566 ENGINEERING OPTICS. (3)

Fundamentals of geometrical and physical optics; applications as related to problems in engineering design and research, details of some optical measurement techniques; introduction to lasers; techniques for determining optical properties. Prereq: Engineering standing. (Same as ME 560.)

EE 567 INTRODUCTION TO LASERS AND MASERS. (3)

Basic principles of laser action; atomic transitions; population inversion; two and three level systems; optical resonators; pumping methods; applications. Prereq: EE 360, EE 468G, or PHY 417G, or consent of instructor. (Same as PHY 567.)

EE 568 FIBER OPTICS. (3)

The course presents theory and practice related to (a) fiber optic cable and their fabrication, (b) fiber optic transmitters and detectors, (c) fiber optic communication systems and (d) fiber optic remote sensors. Prereq: EE 468G. (Same as MSE 568.)

EE 569 ELECTRONIC PACKAGING SYSTEMS AND MANUFACTURING PROCESSES. (3)

Study of packaging systems which interconnect, support, power, cool, protect, and maintain electronic components. The course will address systems at the chip, board, and product levels. Topics include design, properties, materials, manufacture, and performance of various packaging systems. Laboratory will provide familiarity with design software and production equipment and processes. Prereq: EE 211 or EE 305, EE 360 or MSE 402G, or consent of instructor. (Same as MSE 569.)

EE 570 FUNDAMENTALS OF NANOELECTRONIC DEVICES AND MATERIALS. (3)

Energy bands in crystals; heterostructures; quantum wells and low dimensional systems; the two-dimensional electron gas and MODFET; transmission in nanostructures; current topics in nanoscale devices. Prereq: EE 360 and engineering standing, or consent of instructor. (Same as ME/MSE 570.)

EE 571 FEEDBACK CONTROL DESIGN. (3)

System representation via transfer function and state variables, root locus analysis; Bode plots; compensation by root-locus and frequency response methods; state variable feedback; sensitivity analysis; tracking via output feedback; digital control systems. Prereq: EE 421G, EE 422G, engineering standing, and consent of instructor.

EE 572 DIGITAL CONTROL OF DYNAMIC SYSTEMS. (3)

Zero and first order hold, theory of analog to digital and digital to analog conversion. Z-transform analysis, discrete state variable analysis, discrete estimation techniques, error analysis of discrete systems. Prereq: EE 422G, engineering standing.

EE 575 INDUSTRIAL CONTROL. (3)

Control technologies for industrial and process control systems, including sensors, actuators, PLCs, and hydraulic and pneumatic control elements. Prereq: Engineering standing or graduate standing.

EE 579 NEURAL ENGINEERING: MERGING ENGINEERING WITH NEUROSCIENCE. (3)

A multidisciplinary approach combining engineering principles for systems analysis and control, knowledge of biological control mechanisms, and computational properties of biological neural networks in the development of engineering neural networks for control applications. Topics include: equivalent circuit models for biological neurons and networks, non-linear differential equation representations, biological control strategies for rhythmic movements, design and development of controller for robot function, proposal development and presentation. Prereq: EE 422G and Engineering Standing or consent

of instructor. (Same as BME 579.)

EE 580 EMBEDDED SYSTEM DESIGN. (3)

Embedded System Design covers the design and implementation of hardware and software for embedded computer systems. Topics include architectural support for embedded systems, power management, analog and digital I/O, real-time processing design constraints and the design of embedded systems using a real-time operating systems. Prereq: EE/CPE 287, EE/CPE 380, and engineering standing or consent of instructor. (Same as CPE 580.)

EE 582 HARDWARE DESCRIPTION LANGUAGES AND PROGRAMMABLE LOGIC. (3)

A study of hardware description languages including netlists, VHDL and Verilog; their use in digital design methodologies including modeling techniques, design verification, simulation, synthesis, and implementation in programmable and fabricated logic media. Programmable logic topics include CPLD and FPGA architectures, programming technologies and techniques. Prereq: EE/CS 380 and engineering standing.

EE 584 INTRODUCTION OF VLSI DESIGN AND TESTING. (3)

Introduction to the design and layout of Very Large Scale Integrated (VLSI) Circuits for complex digital systems; fundamentals of the VLSI fabrication process; and introduction to VLSI testing and structured design for testability techniques. Prereq: Engineering standing or consent of instructor. (Same as CPE 584.)

EE 585 FAULT TOLERANT COMPUTING. (3)

Students in this course study the theory and practice of fault-tolerant and dependable computing systems. The course will introduce sources of faults, error and failures in computer controlled systems and approaches to design masking and recovery techniques at the hardware, software, and systems level. Prereq: EE/CPE 380 and engineering standing or consent of the instructor. (Same as CPE 585.)

EE 586 COMMUNICATION AND SWITCHING NETWORKS. (3)

Fundamentals of modern communication networking and telecommunications, data transmission, multiplexing, circuit switching networks, network topology routing and control, computer communication, packet switching networks, congestion control, frame relay, ATM switching networks, traffic and congestion control. Prereq: EE/CPE 282 and engineering standing. (Same as CPE 586.)

EE 587 ADVANCED EMBEDDED SYSTEMS. (3)

An advanced course in the design of embedded systems using state-of-the art microcontroller hardware and software development tools. Topics include architecture support for real-time operating systems, language support for embedded and real-time processing, embedded and wireless networking. Prereq: EE/CPE 580 and engineering standing or consent of instructor. (Same as CPE/CS 587.)

EE 588 REAL-TIME COMPUTER SYSTEMS. (3)

This course covers features typically found in real-time and embedded systems. Topics include real-time operating systems, scheduling synchronization, and architectural features of single and multiple processor real-time and embedded systems. Prereq: EE/CPE 580 and engineering standing or consent of instructor. (Same as CPE 588.)

EE 589 ADVANCED VLSI. (3)

An advanced class in topics related to Very Large Scale Integration. Example topics are advanced simulation, yield impact, memory design, statistical analysis and data reduction. Prereq: EE 584, engineering standing.

EE 595 INDEPENDENT PROBLEMS. (1-3)

For electrical engineers. A problem, approved by the chairperson of the department, provides an objective for study and research. May be repeated to a maximum of six credits. Prereq: 2.5 standing and engineering standing.

EE 598 SPEC. TOPICS MULTI-INST (Subtitle required). (3)

This course covers advanced topics on various aspects of electrical engineering, and is a template for courses to be shared among multiinstitutions via distance learning technologies.

EE 599 TOPICS IN ELECTRICAL ENGINEERING (Subtitle required). (3)

A detailed investigation of a topic of current significance in electrical engineering such as biomedical instrumentation, digital filter design, active networks, advanced electrical devices, digital communications, display of electronics. May be repeated, but only three credits can be earned under the same title. Only nine credit hours may count toward degree requirements. A particular topic may be offered at most twice under the EE 599 number. Prereq: Equivalent of two 400-level courses in electrical engineering, consent of instructor and engineering standing.

EE 601 ELECTROMAGNETIC ENERGY CONVERSION I. (3)

Generalized electric machine theory; parameter determination. Energy conversion in continuous media including magnetohydrodynamics. Prereq: Consent of instructor.

EE 603 POWER ELECTRONICS. (3)

Study of solid-state power electronic devices and their applications. Examination of control philosophies, steady-state models, and numerical simulation of characterizing differential equations. Current topics of interest from the literature. This course may not be used to satisfy degree requirements if credit is earned in EE 503. Prereq: EE 517 and EE 571 or consent of instructor.

EE 604 SWITCH MODE CONVERTERS. (3)

Study of analysis techniques for switching mode converters and associated control practices. Boost, buck, buck-boost, flyback, and Cuk topologies in both continuous and discontinuous conduction modes are presented. Numerical solution, state-space averaging, and linearization techniques are applied to predict performance and formulate transfer characteristics. Prereq: EE 517 or consent of instructor.

EE 605 MODELING, SIMULATION AND CONTROL FOR MANUFACTURING. (3)

The purpose of this course is to examine methods and systems from the perspectives of modeling, simulation, and control of manufacturing facilities. The emphasis will be primarily on techniques that can be used to model and evaluate performance of systems. Students are encouraged to think critically about available technologies, identify relative strengths and weaknesses, and analyze the technologies toward developing improved solutions to factory control and information management problems. Prereq: Graduate Standing. (Same as ME/MFS605.)

EE 606 GLOBAL ISSUES IN MANUFACTURING. (3)

The need to increase quality, productivity, efficiency and sustainability in manufacturing operations spanning the product, process and systems (manufacturing systems as well as supply chain) domains is essential for companies to be successful. The increased globalization of markets and manufacturing operations, declining natural resources and negative consequences of some manufacturing practices as well as increased legislation in many regions has led to many new challenges that companies must overcome to be successful in competitive markets. This seminar course will introduce students to a variety of global issues in manufacturing through presentations by leading national and international experts in these domains. The seminars will cover a broad range of manufacturing related topics relevant to many

disciplines including manufacturing, mechanical and electrical engineering. The course can also help graduate students identify topical issues that need further investigation and could become potential research topics. (Same as ME/MFS 606.)

EE 611 DETERMINISTIC SYSTEMS. (3)

Concepts of linear systems, singularity functions, convolution and superposition integrals, state-variable method for linear systems, relation between transfer function and state-variable equations, fundamental matrix, state-transition matrix, unit-impulse response matrix, and transmission matrix. Prereq: EE 421G.

EE 613 OPTIMAL CONTROL THEORY. (3)

State-space modeling of control systems; variational techniques; system optimization by maximum principle, dynamic programming; Hamilton-Jacobi equations design of linear optimal systems; computational methods for solving boundary value problems. Prereq: EE 611.

EE 614 ADAPTIVE CONTROL. (3)

Real-time parameter estimation; deterministic self-tuning regulators; stochastic and predictive self-tuning regulators; model-reference systems; auto-tuning; gain scheduling; practical issues; design and simulation projects. Prereq: EE 611.

EE 619 PROBLEMS SEMINAR IN OPERATIONS RESEARCH. (3)

In this course, the student is exposed to the art of applying the tools of operations research to real world problems. The seminar is generally conducted by a group of faculty members from the various disciplines to which operations research is applicable. Prereq: MA 617 and STA 525 or consent of instructor.

EE 621 ELECTROMAGNETIC FIELDS. (3)

Development of electromagnetic field theory from the basic postulates of Maxwell's equations in differential and integral forms, solution to static, quasistatic, and wave-propagation problems. Radiation from dipole antenna elements. Prereq: EE 468G.

EE 622 ADVANCED ELECTRODYNAMICS. (3)

Solution methods for applied electrodynamics problems; uniqueness, equivalence, duality, reciprocity; linear space methods; wave solutions in separable coordinate systems; classical problems in cartesian, cylindrical, and spherical coordinates. Prereq: EE 468G.

EE 624 COMPUTATIONAL ELECTROMAGNETICS: THE FINITE-DIFFERENCE TIME-DOMAIN. (3)

A course on the application of the finite-difference time-domain (FDTD) technique for the full-wave simulation of time-dependent electromagnetic waves in complex media. Representative topics in the course include: The Yee-algorithm, numerical dispersion and stability, physical source models, absorbing boundaries and perfectly matched layered media, near-field to far-field transformations, modeling of microwave circuits and antennas, parameter extraction, lumped load models, non-uniform and non-orthogonal grid methods, and current topics in FDTD. Prereq: EE 621 or consent of instructor.

EE 625 COMPUTATIONAL ELECTROMAGNETICS. (3)

This advanced course in computational electromagnetics primarily covers moment method and finite element method solutions to scattering problems. Representative topics of the course include surface and volume equivalence principles, scattering by material cylinders, scattering by periodic structures and absorbing boundary condition models. Prereq: EE 525, EE 621, or consent of instructor.

EE 630 DIGITAL SIGNAL PROCESSING. (3)

An introductory treatment of the basic concepts of signal processing via time and frequency domain

(Z-transform) methods and a survey of procedures for designing, implementing and using digital signal processors. Prereq: EE 512 or consent of instructor.

EE 635 IMAGE PROCESSING. (3)

The course outlines applications of image processing and addresses basic operations involved. Topics covered include image perception, transforms, compression, enhancement, restoration, segmentation, and matching. Prereq: Graduate standing and consent of instructor. (Same as CS 635.)

EE 639 ADVANCED TOPICS IN SIGNAL PROCESSING AND COMMUNICATIONS. (3)

Advanced topics in signal processing and communications research and design topics of current interests, such as optical processing, pattern recognition, satellite systems, and digital communication networks. A review and extension of current literature and selected papers and reports. May be repeated to a maximum of nine credits. Prereq: Advanced graduate standing.

EE 640 STOCHASTIC SYSTEMS. (3)

Random variables, stochastic processes, stationary processes, correlation and power spectrum, mean-square estimation, filter design, decision theory, Markoff processes, simulation. Prereq: EE 421G.

EE 641 ADVANCED POWER SYSTEMS. (3)

This course covers advanced topics on electric power systems including power system analysis, operation, monitoring, protection, optimization and control. Prereq: Graduate student, AND EE 415 or equivalent or consent of instructor.

EE 645 ADVANCED CONTROL SYSTEM ANALYSIS. (3)

Conceptual development and study of complex systems; their synthesis and design; analysis and optimization of system parameters. Inputoutput relationships; formulation of mathematical models, parameters and constraints on physical systems. Prereq: ME 440 or instructor consent. (Same as ME 645.)

EE 661 SOLID-STATE ELECTRONICS. (3)

A study of semiconductor fundamentals including crystal structure, basic quantum mechanics, energy-band theory, carrier distributions, carrier transport, and recombination-generation. Analysis of semiconductor devices including PN junction diodes, bipolar-junction transistors, metal-semiconductor diodes, and metal-oxide semiconductor field effect transistors. Prereq: EE 360 and EE 461G or consent of instructor.

EE 663 OPTOELECTRONIC DEVICES. (3)

Theory and applications of photodetectors, solar cells, semiconductor lasers, light emitting diodes and display devices, nanocrystalline structures and organic semiconductors applications in optoelectronic devices. Prereq: EE 360 or MSE 402G, consent of instructor and/ or graduate standing. (Same as MSE 663.)

EE 664 MULTIDISCIPLINARY SENSORS LABORATORY. (3)

A multidisciplinary laboratory course with laboratory experiences in areas related to sensors and sensing architectures, typically including chemistry, chemical and materials engineering, and electrical engineering. Lecture, 1 hour; laboratory, 2 hours. Prereq: One year of college chemistry, calculus and physics. GS 660 or by consent of instructor. (Same as CHE/CME/MSE 664.)

EE 672 NONLINEAR SYSTEMS AND CONTROL. (3)

This course presents methods for analyzing and controlling nonlinear dynamic systems. The major topics are: 1) fundamental properties of nonlinear ordinary differential equations such as existence and uniqueness; 2) Lyapunov stability theory; and 3) nonlinear feedback control techniques such as

backstepping, feedback linearization, and Lyapunov-based design. (Same as ME 672.)

EE 684 INTRODUCTION TO COMPUTER AIDED DESIGN OF VLSI CIRCUITS. (3)

Computer aided design of Very Large Scale Integration (VLSI) circuits. Topics include: VLSI technologies, CMOS circuit characteristics, computer aids in the design of VLSI circuits, use of various CAD tools for layout, circuit design, logic design, and functional design, and the use of VLSI circuits in the system design. A design project is required. Prereq: EE 581 and EE 461G or consent of instructor.

EE 685 DIGITAL COMPUTER STRUCTURE. (3)

Study of fundamental concepts in digital computer system structure and design. Topics include: computer system modeling based on instruction set processor (ISP) and processor-memory-switch (PMS) models, design and algorithms for ALU, processor, control unit and memory system. Special topics include floating-point arithmetic, cache design, pipeline design technologies, and parallel computer architectures. Prereq: EE 380 and EE 581 or consent of instructor.

EE 686 ADVANCED COMPUTER ARCHITECTURE DESIGN. (3)

A study of current diverse advanced architectures such as microprogrammed, parallel, array and vector, networked, and distributed architectures; applications and example systems employing these architectures; matching applications to architectures; consideration of architectures of the future. Prereq: EE 685.

EE 698 SPEC. TOPICS MULTI-INST (Subtitle required). (3)

This course covers advanced topics on various aspects of electrical engineering, and is a template for courses to be shared among multiinstitutions via distance learning technologies.

EE 699 TOPICS IN ELECTRICAL ENGINEERING (Subtitle required). (3)

A detailed study of a topic of current interest in electrical engineering. May be repeated to a maximum of six credits, but only three credits may be earned under the same subtitle. A particular topic may be offered at most twice under the EE 699 number. Prereq: Consent of instructor.

EE 748 MASTER'S THESIS RESEARCH. (0)

Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.

EE 749 DISSERTATION RESEARCH. (0)

Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.

EE 767 DISSERTATION RESIDENCY CREDIT. (2)

Residency credit for dissertation research after the qualifying examination. Students may register for this course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended.

EE 768 RESIDENCE CREDIT FOR THE MASTER'S DEGREE. (1-6)

May be repeated to a maximum of 12 hours.

EE 769 RESIDENCE CREDIT FOR THE DOCTOR'S DEGREE. (0-12)

May be repeated indefinitely.

EE 780 ADVANCED PRACTICE IN ELECTRICAL AND COMPUTER ENGINEERING. (1-3)

Apply advanced training in electrical/computer engineering to solve complex practical problems through analysis, design, implementation, experiments, and/or developments subject to approval of the course instructor. This course may be repeated for a maximum of six credit hours in combination with EE 783. Prereq: 18 hours of graduate courses.

EE 783 SPECIAL PROBLEMS IN ELECTRICAL ENGINEERING. (1-3)

Open to graduate students only. Individual work on an assignment approved by the chairperson of the department. May be repeated to a maximum of nine credits.

EE 784 RESEARCH PROJECT IN ELECTRICAL ENGINEERING. (3)

Individual study related to a special research project supervised by the student's advisor. A final written report on the project is required. This course is open only to and required by students pursuing the MSEE degree with a non-thesis option (Plan B). The course cannot satisfy part of the required 30 hours of course work for Plan B. Prereq: Approval of student's MSEE advisor.

EE 790 RESEARCH IN ELECTRICAL ENGINEERING. (1-9)

Research in any field of electrical and/or computer engineering subject to approval of the Director of Graduate Studies. This course can be taken prior to the qualifying examination, but will not count for pre-qualifying examination residency credit. This course may be repeated to a maximum of 18 credit hours. Prereq: Consent of DGS.

