Graduate Council Report
7 December 2006

Graduate Council approved the Department of Electrical and Computer Engineering request to have the ELEN course prefix changed to ECEN.
October 23, 2006

MEMORANDUM

TO: Dr. B. Knight  
   Chair of Curriculum Committee

THROUGH: Dr. R. Giardino  
          Dean of Graduate Studies

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   Dr. N.K. Anand  
   Assistant Dean, College of Engineering

FROM: Dr. C. Georgiades  
      Department Head

SUBJECT: Changing Course Prefix from ELEN to ECEN

We are requesting that the following ELEN courses have the prefix changed to ECEN. The Department name change, Electrical and Computer Engineering was effective in the Fall of 2005 and we would like the courses to reflect on the department name change.

I appreciate your cooperation in this matter.

CC: Attachments  
   Ms. L. Lacey

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Approved at Nov. 15, 2006 COE GIC Meeting.
and power electronics, solid state electronics, photonics and nano-engineering, telecommunications and signal processing. Interdisciplinary engineering programs are available in other areas.

Well equipped laboratories are available for work in all of these areas. Special laboratory facilities are available to graduate students in telecommunications, solid-state electronics, integrated circuit design, electromagnetics, microwave microelectronics, electromotrics, computer vision and electric power systems. The department has many workstations and high end PCs in general access laboratories and excellent computing facilities available in the individual research laboratories. The workstations are supported by a large Sun file servers and two computational servers, and the PCs are supported by a Novell network.

There is no foreign language requirement for the PhD or DEng programs in electrical and computer engineering.

- Electrical Engineering (ELEN)
- and Computer


602. Computer Communication and Networking. (3-0). Credit 3. Computer communication and computer networks; use of the International Standards Organization (ISO) seven-layer Open Systems Interconnection model as basis for systematic approach; operational networks to be included in the study of each layer; homework assignments to make use of a campus computer network. Prerequisite: ELEN 646 or equivalent probability background.

603. Time-frequency Analysis and Multirate Signal Processing. (3-0). Credit 3. Basic functions; short-time Fourier transform; Gabor transform; linear time-scale/time-frequency analysis; time-frequency resolution; Wigner-Ville distribution; Ambiguity function; wavelet series; multi-rate filter banks; orthogonality and biorthogonality; subband coding and pattern recognition.

604. Channel Coding for Communications Systems. (3-0). Credit 3. Channel coding for error control, finite field algebra, block codes, cyclic codes; BCH codes; and convolutional codes; Trellis coded modulation, including ungarenbeck codes and coset codes; performance on gaussian and rayleigh channels; applications to communications systems. Prerequisite: Approval of instructor and graduate classification.

605. Linear Control Systems. (3-3). Credit 4. Application of state variable and complex frequency domain techniques to analysis and synthesis of multivariable control systems. Prerequisite: ELEN 420 or equivalent.

606. Nonlinear Control Systems. (3-0). Credit 3. Techniques available to analyze and synthesize nonlinear and discontinuous control systems. Modern stability theory, time-varying systems, DE, DIDE, Lyapunov Theory, adaptive control, identification and design principles for using these concepts; examples from a variety of electronic and electromechanical systems. Prerequisite: ELEN 605.

607. Advanced Analog Circuit Design Techniques. (3-2). Credit 4. Design of analog circuits using conventional and non-conventional voltage techniques, including floating gate, bulk driven and enhanced wide swing structures. Prerequisite: ELEN 474 or approval of instructor.

608. Modern Control. (3-0). Credit 3. Vector Norms; Induced Operator Norms; lp stability; the small gain theorem; performance/robustness trade-offs; L1 and Hoo optimal P control as operator norm minimization; H2 optimal control. Prerequisite: ELEN 605 or equivalent. Cross-listed with MEEN 674.

609. Adaptive Control. (3-0). Credit 3. Basic principles of parameter identification and parameter adaptive control, robustness and examples of instability; development of a unified approach to the design of robust adaptive schemes. Prerequisite: ELEN 605 or approval of instructor. Cross-listed with MEEN 675.

610. Data Converters. (3-2). Credit 4. Introduction to data converters, specifications, Nyquist rate and oversampled converters, successive approximations, flash, two step-flash, pipeline, parallel architectures, Sigma delta technique, Basic concepts, order of modular, Match solution, limitation of non-idealities to Sigma delta performances, decimation and filters. Prerequisite: ELEN 474 or approval of instructor.

611. General Theory of Electromechanical Motion Devices. (3-0). Credit 3. Winding function theory; inductances of an ideal doubly cylindrical machine; inductances of salient-pole machines, reference frame and transformation theory; dynamic equations of electric machines; steady-state behavior of electric machines. Prerequisite: Approval of instructor or graduate classification.
612. Computer Aided Design of Electromechanical Motion Devices. (3-0). Credit 3. Magnetic circuits and field distribution of electric machines; main flux path calculation; calculation of magnetizing and leakage inductance; calculation of electric machine losses; principle of design of various electric machines; finite element design of electromechanical motion devices. Prerequisite: Approval of instructor or graduate classification.

613. Rectifier and Inverter Circuits. (3-0). Credit 3. Analysis/design of single phase, three phase rectifiers; phase control and PWM rectifiers; line harmonics; power factor; harmonic standards; passive and active correction methods; inverters; PWM methods; effect of blanking time; zero voltage switching and multilevel inverter; application of these systems in UPS and AC motor drives. Prerequisite: ELEN 438 or approval of instructor.

614. Power System State Estimation. (3-0). Credit 3. The large electric power system state estimation problem; issues of network observability; bad measurements detection/identification; sparse matrix vector techniques for computational efficiency. Prerequisite: ELEN 460.

615. Methods of Electric Power Systems Analysis. (3-0). Credit 3. Digital computer methods for solution of the load flow problem; load flow approximations; equivalents; optimal load flow. Prerequisite: ELEN 460 or approval of instructor.


618. Resilient Computer Systems. (3-0). Credit 3. Impact of reliability on computer and network systems design; stochastic models of reliability and availability in fault-tolerant systems; hardware, software and system interaction, system design for testability, isolation and recovery. Prerequisite: ELEN 350 or CPSC 410. Cross-listed with CPSC 618.

620. Network Theory. (3-0). Credit 3. Development and application of advanced topics in circuit analysis and synthesis in both the continuous and discrete time and frequency domains. Prerequisite: ELEN 326 or equivalent.


623. Parallel Geometric Computing. (3-0). Credit 3. Parallel computer architectures and algorithms for solving geometric problems raised in VLSI design, pattern recognition and graphics; advanced research results in computational geometry including convexity, proximity, intersection, geometric searching and optimization problems. Prerequisite: CPSC 311 or ELEN 350. Cross-listed with CPSC 623.

624. IC Design Tools. (3-0). Credit 3. Use of several CAD tools, not covered in other classes, oriented towards the solution of more advanced IC design tasks; the underlying theoretical principles, problem solved and basic solution methods. Prerequisite: Approval of instructor.

627. Multimedia Systems and Networks. (3-0). Credit 3. Research topics in multimedia storage and delivery; real-time scheduling (processor, disk, network); guaranteed service, statistical guarantees, best-effort, IP Multicast audio/video compression standard, multicast applications, congestion control. Prerequisite: ELEN 602 or CPSC 619.

628. Linear System Theory. (3-0). Credit 3. Application of functional analysis and geometric concepts to the analysis and synthesis of control systems. Prerequisite: ELEN 605.

630. Analysis of Power Electronic Systems. (3-0). Credit 3. Analysis and control of semiconductor switching power converters using specialized methods such as Fourier series, state-space averaging, time domain transfer functions, sliding mode, quadrature and other discontinuous orthogonal functions; application of the above techniques in practice; selected research publications. Prerequisite: Approval of instructor.

631. Fiber-Optic Devices. (3-0). Credit 3. Fiber optic waveguides; directional couplers; polarization; poincare sphere fractional wave devices; PM fiber; interferometric devices and sensors fiber gyroscope; faraday effect devices; multiplexing techniques. Prerequisite: Approval of instructor.

632. Motor Drive Dynamics. (3-0). Credit 3. Mathematical analysis of adjustable speed motor drive dynamics; direct torque control in dc and ac machines; the theory of field orientation and vector control in high performance ac motor drives; motion control strategies based on the above theories; microcomputer, signal and power circuit implementation concepts. Prerequisite: Approval of instructor.

633. Optimum Control Systems. (3-0). Credit 3. Variational approach to the development of algorithms for the solution of optimum control problems; necessary and sufficient conditions, numerical methods, and analysis and comparison of optimal control results to classical theory. Prerequisite: ELEN 605.
634. Morphological Methods in Image and Signal Processing. (3-0). Credit 3. Image analysis and signal processing; feature extraction based upon geometrical shape; morphological filtering for image analysis; computer simulation of filter types. Prerequisites: ELEN 447 and 601.

635. Electromagnetic Theory. (3-0). Credit 3. Maxwell's equations, boundary conditions, Poynting's theorem, electromagnetic potentials, Green's functions, Helmholtz's equation, field equivalence theorems; applications to problems involving transmission scattering and diffraction of electromagnetic waves. Prerequisites: ELEN 322; ELEN 351 or equivalent.

636. Phased Arrays. (3-0). Credit 3. Theory and application of phased array antennas, radiators and sensors; spatial and spectral domain analysis of phased arrays including element-by-element, infinite array and Fourier methods; applications will include phased arrays, adaptive arrays, and synthesis array antennas; for use in radar, imaging an biomedical treatment and diagnosis. Prerequisite: ELEN 322 or equivalent.

637. Numerical Methods in Electromagnetics. (3-0). Credit 3. Numerical techniques for solving antenna, scattering and microwave circuits problems; finite difference and finite element differential equation methods with emphasis on the method of moments integral equation technique. Prerequisites: ELEN 351 or 635; CPSC 205 or equivalent.

638. Antennas and Propagation. (3-0). Credit 3. Application of Maxwell's equations to determine electromagnetic fields of antennas; radiation, directional arrays, impedance characteristics, aperture antennas. Prerequisite: ELEN 351.

639. Microwave Circuits. (3-0). Credit 3. Introduction to high frequency systems and circuits; provides background information needed to understand fundamentals of microwave integrated circuits; includes usage of S-parameters, Smith Charts, stability considerations in designing microwave circuits; utilizes CAD program "Super Compact" demonstrating design synthesis optimization and analysis of monolithic devices and circuits. Prerequisite: Graduate classification.

640. Microwave Solid-State Integrated Circuits. (3-0). Credit 3. Microwave two-terminal and three-terminal solid-state devices; waveguide and microstrip solid-state circuits; theory and design of microwave mixers, detectors, modulators, switches, phase shifters, oscillators and amplifiers. Prerequisite: ELEN 351.


642. Electric Power System Reliability. (3-0). Credit 3. Design and application of mathematical models for estimating various measures of reliability in electric power systems. Prerequisite: ELEN 460 or approval of instructor.


644. Pattern Recognition by Neural Networks. (3-0). Credit 3. Feedforward and feedback paradigms; training algorithms; supervised and unsupervised learning; associative networks; self-organizing networks; stability and convergence; comparison with statistical pattern recognition. Prerequisite: ELEN 649 or approval of instructor.

645. Statistical Communication Theory. (3-0). Credit 3. Concepts of probability and random process theory necessary for advanced study of communications, stochastic control and other electrical engineering problems involving uncertainty; applications to elementary detection and estimation problems. Prerequisite: Registration in ELEN 601 or approval of instructor.

646. Information Theory. (3-0). Credit 3. Definition of information; coding of information for transmission over a noisy channel including additive gaussian noise channels and waveform channels; minimum rates at which sources can be encoded; maximum rates at which information can be transmitted over noisy channels. Prerequisite: ELEN 646 or equivalent probability background.

647. Principles of Magnetic Resonance Imaging. (3-0). Credit 3. Introduction to the theory and design of magnetic resonance imaging systems; fundamental physical and mathematical introduction to image acquisition and reconstruction using magnetic resonance; overview of imaging system design, including magnets, imaging gradients and radio-frequency systems, contrast mechanisms, resolution. Prerequisite: ELEN 314 or 322 or approval of instructor.

648. Pattern Recognition. (3-0). Credit 3. Introduction to the underlying principles of classification, and computer recognition of imagery and robotic applications. Prerequisites: MATH 601 and/or STAT 601 and approval of instructor.

650. High Frequency GaAs/AlxGa1-xAs Analog IC Design using non-conventional technolog: broadband communication circuits. Device c require: ELEN 474 or approval of instructor.

651. Microprogrammed Control of Digital System in the design and construction of microprocessor interfacing; data input/output; memories; and with microprocessors and related components.

652. Switching Theory. (3-0). Credit 3. Digital n integrated circuit technologies, analysis an selected switching functions, sequential cir sequential credit synthesis. Prerequisite: Grad.

653. Computer Arithmetic Unit Design. (3-0). C: memory, microprocessor arithmetic logic uni cation and division algorithms and implement ponents and VLSI circuits. Prerequisite: ELE.

654. Very Large Scale Integrated Systems Design such as registers, selecto, PLAs, sequen circuitry with emphasis on high-level, structe, medium scale integrated circuits for fabrication.

655. Advanced Topics in Channel Coding. (3-0). Turbo codes, low density parity check codes, i ciples. Prerequisite: ELEN 604 or graduate c

656. Physical Electronics. (3-0). Credit 3. Elemen semiconductor theory; dielectrics; magnetic devices, such as the laser. Prerequisite: Grad.

657. Quantum Electronics. (3-0). Credit 3. Appli optics including emission, absorption and amulation; nonlinear optics; photodetectors at approval of instructor.

658. Low Noise Electronic Design. (3-0). Credit electronic noise from theory to measurement, of instructor.

659. Parallel/Distributed Numerical Algorithms parallel and distributed numerical algorithms puration or arithmetic expressions; fast algor and nonlinear optimization. Prerequisite: Discrete.

661. Estimation Theory. (3-0). Credit 3. Optimum systems with and without coding; system im channel models. Prerequisite: ELEN 646.

662. Data Compression with Applications to Spectroscopy of waveforms; digital coding of wave coding, runlength coding, sub-band coding. Prerequisites: ELEN 601 and 646.

663. Integrated CMOS RF Circuits and Systems. tems at the theoretical, algorithmic and circulator levels of the communication systems; in technologies. Prerequisites: ELEN 453, 456.

664. Power System Faults and Protective Relayi times during faults; protective relaying pri site: ELEN 460 or approval of instructor.
650. High Frequency GaAs/SiGe Analog IC Design. (3-4). Credit 4. High frequency integrated circuit design using non-conventional technologies such as GaAs and SiGe, with the emphasis on wireless and broadband communication circuits. Device operation, basic building blocks and typical applications. Prerequisite: ELEN 374 or approval of instructor.

651. Microprogrammed Control of Digital Systems. (3-3). Credit 4. Hardware and software concepts involved in the design and construction of microprocessor-based systems: microprocessor architecture, central processing unit, instruction set, interfaces, data input/output, memories, and software development for operation and testing; design projects with microprocessors and related components. Prerequisites: ELEN 350 and 140 or approval of instructor.


653. Computer Arithmetic Unit Design. (3-0). Credit 3. Digital computer arithmetic unit design, control and memory; microprocessor arithmetic logic unit (ALU) design. High-speed addition, subtraction, multiplication and division algorithms and implementations; design and simulation with integrated circuit components and VLSI circuits. Prerequisite: ELEN 651.

654. Very Large Scale Integrated Systems Design. (3-3). Credit 4. Design and fabrication of microelectronic circuits such as registers, selectors, PLAs, sequential and microprogrammed machines via large scale integrated circuitry with emphasis on high-level, structured design methods for VLSI systems. Students design small to medium scale integrated circuits for fabrication by industry. Prerequisites: ELEN 449; ELEN 471 or 473.

655. Advanced Topics in Channel Coding. (3-0). Credit 3. Advanced topics in Channel Coding, including turbo codes, low-density parity check codes, iterative decoding and applications of iterative decoding principles. Prerequisite: ELEN 604 or graduate classification.

656. Physical Electronics. (3-0). Credit 3. Elementary quantum theory; statistical mechanics; semiconductor theory; dielectrics; magnetic materials; quantum electronics: introduction to quantum devices, such as the laser. Prerequisite: Graduate classification or approval of instructor.

657. Quantum Electronics. (3-0). Credit 3. Application of principles of quantum mechanics to problems in optics including emission, absorption and amplification of light, optical resonator and lasers; optical modulation; nonlinear optics; photodetectors and optical receivers. Prerequisites: PHYS 412 and 600 or approval of instructor.

658. Low-Noise Electronic Design. (3-0). Credit 3. Low-noise design; surveying the subject of handling electronic noise from theory to measurement, design, research and developments. Prerequisite: Approval of instructor.


660. Modulation Theory. (3-0). Credit 3. Optimum receiver principles and signal selection for communication systems with and without coding; system implementation, and waveform communication using realistic channel models. Prerequisite: ELEN 646.


662. Data Compression with Applications to Speech and Video. (3-0). Credit 3. Characterization and representation of waveforms; design of coding and modulation techniques, including PCM, delta modulation, DPCM, trellis coding, run-length coding, sub-band coding and transform coding; rate distortion theorems and performance bounds. Prerequisites: ELEN 601 and 646.

663. Integrated CMOS RF Circuits and Systems. (3-2). Credit 4. Introduction to wireless communication systems at the theoretical, algorithmic and circuit levels; emphasis on simulation, and the architecture, transistor levels of the communication systems; focus on circuits implementable on CMOS and BiCMOS technologies. Prerequisites: ELEN 453, 410, 474.

664. Power System Faults and Protective Relaying. (3-0). Credit 3. Calculation of power system currents and voltages during faults: protective relaying principles, application and response to system faults. Prerequisite: ELEN 460 or approval of instructor.
667. Power System Stability. (3-0). Credit 3. Steady-state, dynamic and transient stability of power systems; solution techniques; effect of generator control systems. Prerequisite: ELEN 460 or approval of instructor.

668. High Voltage Direct Current (HVDC) Transmission. (3-0). Credit 3. Overview of HVDC systems; comparison of AC and DC power transmission; study of six-pulse and twelve-pulse power converters; analysis and control of HVDC systems; harmonics and power factor effects; system faults and misoperations; state of the art and future developments in HVDC technology; inspection trips. Prerequisite: Approval of instructor.

669. Engineering Applications in Genomics. (3-0). Credit 3. Tutorial introduction to the current engineering research in genomics. The necessary Molecular Biology background is presented and techniques from signal processing and control are used to (i) unearth intergene relationships (ii) model genetic regulatory networks and (iii) alter their dynamic behavior. Prerequisite: ELEN 605 or approval of instructor.

670. Fiber Optic Networks. (3-0). Credit 3. Components, topologies and architecture for communication networks based on the optical fiber transmission medium; examples based on recent publications in technical literature. Prerequisite: Graduate classification.

671. Solid State Devices. (3-0). Credit 3. Development of mathematical analysis and systematic modeling of solid state devices; relationships of measurable electrical characteristics to morphology and material properties of solid state devices, p-n junction, bipolar and unipolar transistors. Prerequisite: ELEN 656 or approval of instructor.

672. Semiconductor Lasers and Photodetectors. (3-0). Credit 3. III-V compound semiconductor material, spontaneous and stimulated emission in lasers; optical wave guiding, rate equation solutions, quantum noise and spectral linewidth properties of lasers; principle and structure of photodetectors; III-V compound material technology. Prerequisite: ELEN 370.

673. Fundamentals of Microelectronics. (3-0). Credit 3. Microelectronic systems and fabrication technologies; methods of engineering analysis and device characterization. Junction diodes, Schootky diodes, bipolar transistors, junction and MOSt field-effect devices, solar cells, light emitting diodes, charge coupled devices, magnetic bubbles, liquid crystal displays and other newly developed devices and circuits. Prerequisite: Graduate classification or approval of instructor.

674. Introduction to Quantum Computing. (3-0). Credit 3. Introduces the quantum mechanics, quantum gates, quantum circuits and quantum hardware of potential quantum computers; algorithms, potential uses, complexity classes, and evaluation of coherence of these devices. Prerequisites: MATH 304, PHYS 208. Cross-listed with PHYS 674.

675. Integrated Optoelectronics. (3-0). Credit 3. Light propagation and interactions in anisotropic media, electroptic and acoustoptic effects; passive and active guided-wave devices; fabrication and characterization. Prerequisite: ELEN 464 or equivalent.

676. Advanced Computer Architecture. (3-0). Credit 3. Design of advanced computers for parallel processing; emphasis on the overall structure; interconnection networks; including single-stage and multi-stage structures; shared memory and message passing architectures; control-flow and demand-driven programming; multi-threaded architectures; fine-grain and coarse-grain parallelism; SIMD and MIMD; processor designs for parallel operation. Prerequisite: ELEN 651 or CPSC 614 or approval of instructor. Cross-listed with CPSC 676.

677. Control of Electric Power Systems. (3-0). Credit 3. Modeling, analysis and real-time control of electric power systems to meet the requirements of economic dispatch of voltage and power. Prerequisite: Approval of instructor.

678. Statistical Optics. (3-0). Credit 3. Statistics of laser and thermal light; partial polarization; Jones and coherency matrices; Temporal coherence; spatial coherence; mutual coherence; optical noise; detection noise. Prerequisite: ELEN 464.

679. Computer Relays for Electric Power Systems. (3-0). Credit 3. Real-time digital computer application to protective relaying; extensive overview of digital protection algorithms; latest technological advancements as microprocessor-based relays, fiber-optic communication systems, unconventional instrument transformers, dynamic testing tools and methodologies. Prerequisite: Approval of instructor.

680. Testing and Diagnosis of Digital Systems. (3-0). Credit 3. The theory and techniques of testing VLSI-based circuits and systems, and design for testability. Prerequisites: ELEN 220 or 248 or equivalent; ELEN 350 or CPSC 321 or equivalent. Cross-listed with CPSC 680.

681. Seminar. (1-0). Credit 1. Reports and discussion of current research and of selected published technical articles. May not be taken for credit more than once in master's degree program nor twice in PhD program. Prerequisite: Graduate classification in electrical engineering.

Attachment U

682. Spread Spectrum and CDMA. Spread spectrum technology, and frequency hopped spread spectrum burst transmission. Prerequisites: Approval of instructor.

683. Wireless Communication Systems. (3-0). Credit 3. Overview of various wireless systems; techniques of channel coding, modulation, and multiple access. Prerequisite: Approval of instructor.

684. Professional Internship. Credit 1 to 6. Engin. away from the Texas A&M campus; design in these locations; projects selected to match student's and advisor's expertise. Prerequisite: Approval of instructor.

685. Directed Studies. Credit 1 to 12 each semester. Credit for independent research and for projects.


687. VLSI Physical Design Automation. (3-0). Credit 3. Techniques for circuit synthesis, optimization, and verification. Prerequisites: Approval of instructor.

688. IC MEMS and Sensor Fabrication. (3-0). Credit 3. Fabrication and packaging of microelectronic and MEMS devices. Prerequisite: Approval of instructor.

689. Special Topics in... Credit 1 to 6. Advanced topics in the area of microelectronic systems and technology. Prerequisites: Approval of instructor.

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The courses which carry the ENGR designa throughout the college, especially the Doctor of Philosophy in Engineering, also carry the ENGR designations in the respective departments.

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882. Spread Spectrum and CDMA. Spread spectrum communication systems including direct-sequence; multi-carrier, and frequency hopped spread spectrum, pseudo-random sequences, code acquisition and tracking; CDMA, multi-user detection; RAKE receivers, and CDMA standards. Prerequisite: ELEN 646, ELEN 661 or approval of instructor.

883. Wireless Communication Systems. (3-0). Credit 3. The course is on algorithms for VLSI physical design automation, which include partitioning, floor planning, placement, and routing. Technical papers on the above topics will be chosen from premier CAD, conference proceedings, journals and presented in class. Prerequisite: ELEN 248, CPSC 311 knowledge in logic design and computer algorithms.

884. Professional Internship. Credit 1 to 4. Engineering research and design experience at industrial facilities away from the Texas A&M campus; design projects supervised by faculty coordinators and personnel at these locations; projects selected to match student's area of specialization. Prerequisites: Graduate classification and one semester of course work completed.

885. Directed Studies. Credit 1 to 12 each semester. Research problems of limited scope designed primarily to develop research technique.

886. Electric and Hybrid Vehicles. (3-0). Credit 3. Fundamental concepts of electric and hybrid-electric vehicles introduced, component requirements and system design methodologies discussed; vehicle system analysis and simulation methods presented. Prerequisite: Graduate classification or approval of instructor.

887. VLSI Physical Design Automation. (3-0). Credit 3. Wireless applications, modulation formats, wireless channel models and simulation techniques, digital communication over wireless channels, multiple access techniques, wireless standards. Prerequisite: ELEN 646 or approval of instructor.

888. IC MEMS and Sensor Fabrication. (3-3). Credit 4. Fundamental unit processes for the fabrication of silicon IC's and extension of these processes to the specialized micro-machining operations used for MEMS and sensor fabrication; basic process operations used in the laboratory to build simple IC structures; devices then characterized. Prerequisite: ELEN 325, 370, or approval of instructor.

889. Special Topics in... Credit 1 to 4. Advanced topics of current interest in electrical engineering. May be repeated for credit. Prerequisite: Approval of instructor.

891. Research. Credit 1 or more each semester. Research for thesis or dissertation.


893. Analog To Digital Converters. (3-3). Credit 4. The data conversion metrics to evaluate performance is presented, the design and classification of data converters are introduced, discussion on practical applications are given. Prerequisite: Advanced analog or approval of instructor.

Dwight Look College of Engineering

The courses which carry the ENGR designation are offered in support of graduate programs throughout the college, especially the Doctor of Engineering degree. The Doctor of Engineering degree and Interdisciplinary Engineering degrees (see specific degree) are administered through the respective departments.

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