

## Description of Courses

**CPE 500 Software Engineering.** (3 Hours) Examination of the software development life cycle; requirements elicitation; system design; Unified Modeling Language (UML) focus on design; risk analysis; configuration management; testing; maintenance; software project management; team building.

**CPE 505 Analysis of Algorithms.** (3 Hours) Mathematical foundations of algorithms and algorithm analysis; sorting and searching algorithms, graph algorithms, algorithm design techniques, lower bound theory, fast Fourier transforms, NP-completeness.

**CPE 508 Operating Systems.** (3 Hours) Examination of concepts of process communication and synchronization; protection; performance measurement; study of mutual exclusion; concurrent processes; device and memory management; I/O and interrupt structures.

**CPE 512 Computer Architecture.** (3 Hours) Study of architectural features of modern processors, including cache memories and memory systems, pipeline designs, branch prediction techniques; design of superscalar, multithreaded VLIW processors, code optimization for such systems will be studied; quantitative evaluation of architectural features.

**CPE 515 Advanced Logic Design.** (3 Hours) Advanced concepts in Boolean algebra; use of hardware description languages as a practical means to implement hybrid sequential and combinational designs; digital logic simulation; rapid prototyping techniques; design for stability concepts; focuses upon the actual design and implementation of sizeable digital design problems using a representative set of Computer Aided Design (CAD) tools.

**CPE 520 Advanced Engineering Analysis I.** (3 Hours) A comprehensive course to familiarize engineering professionals with advanced applied mathematics as it relates to solving practical engineering problems. The course of intensive study blends the theoretical underpinnings of advanced applied mathematics with an understanding of how these powerful tools can be used to solve practical engineering problems. The material covered includes Ordinary Differential Equations; Linear Algebra, Vector Calculus; Fourier Analysis and Partial Differential Equations.

**CPE 521 Advanced Engineering Analysis II.** (3 Hours) A comprehensive course to familiarize engineering professions with advanced applied mathematics as it relates to solving practical engineering problems. The course of intensive study blends the theoretical un of advanced applied mathematics with an understanding of how these powerful tools can be used to solve practical engineering problems. The material covered includes Complex Analysis; Numerical Methods; Optimization; Graphs; and Probability and Statistics.

**CPE 530 VLSI Design.** (3 Hours) Theory of MOS transistors: fabrication, layout, characterization; CMOS circuit and logic design; circuit and logic simulation, fully complementary CMOS logic, pseudo-NMOS logic, dynamic CMOS logic, pass-transistor logic, clocking strategies; sub system design; ALUs, multipliers, memories, PLAs; architecture design: data path, floor planning, iterative cellular arrays, systolic arrays; VLSI algorithms; chip design and test; full custom design of chips, possible chip fabrication by MOSIS and subsequent chip testing.

**CPE 531 VLSI Testing and Design for Testability.** (3 Hours) Introduction to testing of digital electronic circuits and systems; faults and fault modeling, test equipment, test generation for combinational and sequential circuits, fault simulation, memory and microprocessor testing, design for testability, built-in self-test techniques, and fault location.

**CPE 532 Digital Integrated Circuit Design.** (3 Hours) Design methodologies for digital systems using a modern hardware description language; algorithmic, architectural and implementation aspects of arithmetic processing elements; design of Complex Instruction Set (CISC), Reduced Instruction Set (RISC), and floating point processors; synthesis, simulation and testing of processors with computer-aided design tools.

**CPE 533 Fault-Tolerant Computing Systems.** (3 Hours) Analysis and design of very high reliability and availability systems; fault types, reliability techniques, and maintenance techniques; case studies of high-availability long-life, life-critical systems; both hardware and software techniques for achieving fault-tolerance will be studied.

**CPE 541 Computer Networks.** (3 Hours) Study of computer network architectures, protocols, and interfaces; OSI reference model; Internet architecture; networking techniques (multiple access, packet/cell switching, and internetworking); end-to-end protocols; congestion control; high-speed networking; network management.

**CPE 547 Modeling and Analysis of Computer and Communication Systems.** (3 Hours) Modeling of single and multiprocessor systems, single and multi-stage interconnection networks, computer networks; analysis using Stochastic processes, Markov and Queuing techniques; modeling using Petri Nets and Finite State models.

**CPE 552 Computer Vision.** (3 Hours) Examination of information processing approaches to computer vision; algorithms and architectures for artificial intelligence and robotic systems capable of vision; inference of three-dimensional properties of a scene from its images, such as distance, orientation, motion, size and shape, acquisition and representation of spatial information for navigation and manipulation in robotics.

**CPE 555 Control Systems.** (3 Hours) Analysis and design of control systems with emphasis on modeling and dynamic response; transform and time domain methods for linear control systems; stability theory; root locus, bode diagrams and Nyquist plots; design specification in time and frequency domains; state-space design with computer solutions; compensation design in the time and frequency domain; modern design principles.

**CPE 557 Robotics.** (3 Hours) Fundamentals of robotics; rigid motions; homogenous transformations; forward and inverse kinematics; velocity kinematics; motion planning; trajectory generation; sensing; vision; and control.

**CPE 560 Embedded Design with Microprocessors.**

(3 Hours) Microcomputer system design and use of microprocessors and single chip microcomputers as basic system components; basic microcomputer design and the interface between microprocessor and external devices; course examines the software aspects of microcomputers using assembly language and C programming; single chip microcomputers for embedded and power efficient applications; direct memory access, memory design and management, cache memory, fault tolerance issues, parallel processing with emphasis on hardware issues.

**CPE 601 Code Optimizations.** (3 Hours) Discussion of methods to improve the performance of code generated by compilers; data-flow and dependence analysis, peep-hole optimization, instruction scheduling, and parallelism enhancing transformations; techniques to improve the utilization of registers, instruction level parallelism, and memory hierarchies in modern computer systems.

**CPE 610 Parallel Computing and Programming.**

(3 Hours) Introduction to processing in parallel and distributed computing environments; general concepts of parallel machine models, processes, mutual exclusion, process synchronization, message passing, and programming languages for parallel computing and scheduling; design and analysis of parallel algorithms; performance analysis of parallel algorithms; parallel programming environments: P threads for shared memory multiprocessor systems and PVM/MPI for distributed networks computers.

**CPE 611 Computer Arithmetic.** (3 Hours) Theory and application of computer arithmetic, design, and analysis of computer arithmetic units: fast adders, fast multipliers, shifters, dividers, and floating-point arithmetic units.

**CPE 630 Design Automation of VLSI Systems.** (3 Hours) Theory and algorithms for design automation, design automation tools in VLSI systems, Advanced VLSI design principles, Verilog and VHDL hardware description languages; timing-driven physical design and synthesis, circuit simulation and validation, formal verification, design for reuse and System on Chip (SOC) design methodology.

**CPE 640 Computer Security.** (3 Hours) Comprehensive introduction to field of computer security; security architectures; physical security; communications security; system security; operational security; network and computer risk analysis; invasion and intruder techniques; case studies; in-depth examination of cryptography; biometrics and their application to computer security will be examined.

**CPE 641 Advanced Computer Networks.** (3 Hours) Concepts and fundamental design principles of computer networks and Internet that have contributed to modern network implementations; survey of new trends in networks and Internet/intranet with design of real networks; topics include discussion of fundamental aspects of Internet application layer (HTTP, FTP, DNS), TCP/UDP socket programming, reliable data transfer, congestion control; network layer (IPv4 and IPv6) and routing; link layer and Local Area Networks (LAN); multimedia networking (RTSP, RTP, RSVP, DiffServ); security in computer networks.

**CPE 642 Computer Network Security.** (3 Hours) Principles and concepts in computer network security; introduction to cryptography, confidentiality, authentication, digital signatures, E-mail security, IP security, Web security, intruders, intruder detection, malicious software, firewalls, biometrics as applied to security, and other network security-related issues.

**CPE 655 Advanced Control Systems.** (3 Hours) Linearization of nonlinear systems; phase-plane analysis; Lyapunov stability analysis; adaptive estimation; stability of adaptive control systems.

**CPE 693 Advanced Topics in Engineering.** (Variable 1 to 4 Hours) Pre-requisites: Graduate standing in engineering. Lectures on advanced topics of special interest to students in various areas of computer engineering are introduced. This course number is used to offer and test new courses.

**CPE 695 Scientific Writing Seminar.** (1 Hour) Exercises in scientific writing format and style, with particular emphasis on writing abstracts and manuscripts for publication in referred archival journals.

**CPE 696 Seminar.** (1 Hour) Presentation of papers, projects and reports by visiting lecturers, graduate students, engineers, and community leaders.

**CPE 697 Internship.** (Variable 1-3 Hours) Supervised graduate internship or externship in selected areas. Prerequisite: permission of Department.

**CPE 698 Independent Study.** (Variable 1-4 Hours) Intensive study of a special engineering project including research and literature review selected in accordance with the student's interests and arranged in consultations with the advisor. Topics will vary. Student will make periodic reports as well as a paper at the end of the semester. Prerequisite: permission of Department.

**CPE 699 Thesis Research.** (Variable 1-6 hrs) Master's thesis representing independent and original research. Prerequisite: permission of advisor.