

## Description of Courses

**CPE 500 Software Engineering.** (3 Hours) Focus on software process modeling; user interface design; requirements engineering; CASE tools; reusability; quality assurance; software testing; reliability; distributed computing; database integration; use of Unified Modeling Language (UML) in analysis and design; high-level programming language design as required for software implementation; examination of programming languages for software applications (JAVA,C,C++).

**CPE 502 Telecommunication Software Design.** (3 Hours) Comprehensive course to familiarize telecommunication professionals with the state of the art in software concepts and technologies in modern telecommunications applications; examination of state-of-the-art software concepts and technology in modern telecommunications applications; focus on software process modeling as applied to telecommunications; application of software engineering concepts and processes; user interface design; reusability; reuse; reliability; distributed computing; real-time operating systems; interfacing with Optical/IP Networks; Personal Communication Service (PCS); switch control; heavy emphasis on real world application topics including Optical/IP Network, Intelligent Network (IN) Service Creation, and Cellular/Personal Communication Service (PCS).

**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 534 Coding Theory.** (3 Hours) Introduction to linear codes; error detection and correction; bounds on the error correction capabilities of codes; Hamming distance code; linear block codes; syndrome decoding of linear block codes; cyclic codes; error trapping; decoding; burst error correcting codes; convolutional codes with threshold, sequential and viterbi decoding; cyclic random error correcting codes; P-N sequences; cyclic and convolutional burst error correction codes; other coding conceptions and implementations.

**CPE 540 Telecommunication Systems.** (3 Hours) Preparatory course for all subsequent graduate work in telecommunications; theoretical and technical foundation for the analysis and design of communications systems; use of classical and modern mathematical analysis techniques, including Fourier Series and Fourier Transform; classical modulations techniques (amplitude, frequency, phase).

**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 542 Computer and Network Security.** (3 Hours) In-depth examination of computer and network security; coverage of encryption, public/private keys, certificates, security of wired and wireless communication systems; invasion and intrusion techniques and detection; security architectures; network and computer risk analysis; biometrics and their application to computer security will be examined.

**CPE 543 Wireless Communication Systems.** (3 Hours) Principles of mobile communication systems; models of wave propagation; compensation for fading; modulation, demodulations; coding, encoding; multiple-access techniques; performance characteristics of mobile systems; wireless device characteristics; low-power mobile devices; wireless communication system design; mobile and cell antenna designs.

**CPE 545 Antennas.** (3 Hours) Examine the theory and properties of various communication antennas covering the range from RF frequencies to millimeter wavelengths; examine actual antennas and their characteristics.

**CPE 546 Digital Communication Systems.** (3 Hours) Maxwell's equations; numerical propagation of scalar waves; numerical implementation of boundary conditions; absorbing boundary conditions for free space and waveguides; selected applications in telecommunications, antennas, microelectronics, digital systems.

**CPE 551 Digital Signal Processing.** (3 Hours) Signals and systems; sampling continuous-time signals and reconstructions of continuous-time signals from samples; spectral analysis of signal using the discrete Fourier

transform; the fast Fourier transform and fast convolution methods; z-transforms; finite and infinite impulse response filter design techniques; signal flow graphs and introduction to filter implementation.

**CPE 643 Wireless Networks.** (3 Hours) Wireless architectures and networking; examination of both wireless LANs and mobile wireless networks; wireless network protocols; channel and resource allocation; mobile IP; wireless data management; Quality of Service (QoS); performance modeling; related wireless networking topics; examination of various architectures and standards (802.11, 802.15, 802.16), IR, and other related protocols.

**CPE 644 Optical Communication Systems.** (3 Hours) Principles of optical communication systems and fiber optic communication technology; characteristics of optical fibers, laser diodes, and laser modulation; laser and fiber amplifiers; detection; demodulation; dispersion compensation; system typologies.

**CPE 645 Microwave Circuits and Systems.** (3 Hours) Operating principles of devices at microwave and millimeter wave frequencies; sources; detectors; waveguide; cavities; antennas; scattering parameters; impedance matching; system design.

**CPE 646 Global Positioning Systems and Location Services.** (3 Hours) Examination of satellite navigation systems; overview of transition from radio navigation systems to modern satellite-based systems; examination of satellite signal propagation, clock accuracy, and injected errors and their effect on accuracy; application of GPS and location services as related to autonomous mobile vehicles and public safety; examination of alternative location services and their comparison to GPS.

**CPE 647 Mobile Computing Systems.** (3 Hours) Overview of the emerging field of mobile computing; land mobile vs. satellite vs. in-building communications systems; RF vs. IR; cellular telephony; mobility support in cellular telephone networks; Personal Communications Systems/Personal Communications Networks; wireless local area networks; direct broadcast satellite; low earth orbiting satellites; examination of data management, reliability issues; mobile IP; end-to-end communication; channel and other resource allocation; routing protocols; 2G and 3G standards and protocols such as TDMA, CDMA, GSM, PCS will be discussed.

**CPE 648 Wireless Sensor Networks.** (3 Hours) Survey of the field of wireless communications as related to low-power embedded sensor networks including communications standards and protocols, e.g. 802.11, Bluetooth, 802.15.4/Zigbee; examination of network services including reliable delivery, routing, naming, and security; examination of system architectures, operating systems and language support, distributed algorithms, and applications for wireless sensor networks; target tracking, data collection and analysis, power and resource management; a sensor network is implemented during the course.

**CPE 649 Telecommunications Network Management.**

(3 Hours) Systematic examination of standards, basic concepts, current practices in telecom system management; Telecommunications Network Management (TNM) and OSI coverage; coverage of major telecom management standards; examination of management issues relating to both wireless mobile networks and traditional telecom systems, coverage of essential features of TNM architectures; examination of management of telecommunication network equipment and services; interoperability in a multi-supplier environment.

**CPE 670 Wireless Design Lab.** (3 Hours) Laboratory experiments directed towards in-depth understanding of the implementation of components used in wireless communications; practical experience in the use of Bluetooth, WiFi, 802.11, and RF related components and networks.

**CPE 671 3G and 4G Wireless Networks.** (3 Hours) Examination of the technical, business, and regulatory issues surrounding third and fourth generation (3G and 4G) wireless communication systems; examination of the evolution of the various generation of wireless communications; focus on CDMA, Wideband CDMA, 3G, GSM, 4G designs and applications; extensive use of case studies; examination of both protocols and physical implementations.

**CPE 672 Network Quality Assurance and Simulation.**

(3 Hours) Focus on the theoretical and practical aspects of network simulation and quality assurance; fundamentals of simulation and statistical modeling; random variable distributions; random number generation; wireless network performance; distributed systems; distributed and parallel systems and services; resolution in simulation; modeling and abstraction in multilevel simulation; distributed simulation consideration; implementation of actual network simulation and modeling project.

**CPE 673 Wireless Internet Applications Development.**

(3 Hours) Course focuses on the Wireless Application Protocol (WAP) and the Wireless Markup Language (WML), Microsoft Mobile .Net framework, Java Server Pages, Active Server Pages, CGI, and related protocols; attention is

directed to development of applications using both thin and thick client models; course is composed of development of applications using both simulators and actual application servers and wireless devices such as WAP enabled phones, PDAs, and personal communication devices.

**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.