Telecommunications Engineering Course Descriptions

Electrical Engineering Courses

EE 5305 Radio Frequency Engineering (3 semester hours) Introduction to generation, transmission, and radiation of electromagnetic waves. Microwave-frequency measurement techniques. Characteristics of guided-wave structures. Impedance matching. Fundamentals of antennas and propagation. Prerequisite: EE 4301 or equivalent. (3-1) Y

EE 6310 Optical Communications Systems (3 semester hours) Operating principles of optical communications systems and fiber optic communication technology. Characteristics of optical fibers, laser diodes, laser modulation, laser and fiber amplifiers, detection, demodulation, dispersion compensation, and network topologies. System topology, star network, bus networks, layered architectures, all-optical networks. Prerequisite: EE 3350 or equivalent. (3-0) T

EE 6316 Fields and Waves (3 semester hours) Study of electromagnetic wave propagation beginning with Maxwell's equations; reflection and refraction at plane boundaries; guided wave propagation; radiation from dipole antennas and arrays; reciprocity theory; basics of transmission line theory and waveguides. Prerequisite: EE 4301 or equivalent. (3-0) Y

EE 6341 Information Theory I (3 semester hours) Self information, mutual information, discrete memoryless sources, entropy, source coding for discrete memoryless channels, homogeneous Markov sources, discrete memoryless channels, channel capacity, converse to the coding theorem, noisy channel coding theorem, random coding exponent, Shannon limit. Prerequisite: EE 6352. (3-0) R

EE 6343 Detection and Estimation Theory (3 semester hours) Parameter estimation. Least-square, mean-square, and minimum-variance estimators. Maximum A Posterior (MAP) and Maximum-Likelihood (ML) estimators. Bayes estimation. Cramer-Rao lower bound. Continuous and discrete time detection and estimation. Prerequisite: EE 6349. (3-0) R

EE 6344 Coding Theory (3 semester hours) Groups, fields, construction and properties of Galois fields, error detection and correction, Hamming distance, linear block codes, syndrome decoding of linear block codes, cyclic codes, BCH codes, error trapping decoding and majority logic decoding of cyclic codes, non-binary codes, Reed Solomon codes, burst error correcting codes, convolutional codes, Viterbi decoding of convolutional codes. Prerequisite: EE 6352. (3-0) R

EE 6345 Engineering of Packet-Switched Networks (3 semester hours) Detailed coverage, from an engineering point of view, of the physical, data-link, network and transport layers of IP (Internet Protocol) networks. This course is a Masters-level introduction to packet networks. Prior knowledge of digital communication systems is strongly recommended. Prerequisite: EE 3350 or equivalent. (3-0) Y

EE 6349 Random Processes (3 semester hours) Random processes concept. Stationary and independence. Autocorrelation and cross-correlation functions, spectral characteristics. Linear systems with random inputs. Special topics and applications. Prerequisites: EE 3302 and EE 3341 or equivalents. (3-0) Y

EE 6352 Digital Communication Systems (3 semester hours) Digital communication systems are discussed. Source coding and channel coding techniques are introduced. Signaling schemes and performance of binary and M-ary modulated digital communication systems. The overall design considerations and performance evaluations of various digital communication systems are emphasized. Prerequisites: EE 6349 or equivalent. (3-0) Y

EE 6355 RF and Microwave Communication Circuits (3 semester hours) Design of high frequency communication circuits. Prerequisite: EE 4368 or equivalent. (3-0) R

EE 6360 Digital Signal Processing I (3 semester hours) Analysis of discrete time signals and systems, Z-transform, discrete Fourier transform, fast Fourier transform, analysis and design of digital filters. Prerequisite: EE 3302 or EE 4361 or equivalent. (3-0) Y

EE 6361 Digital Signal Processing II (3 semester hours) Continuation of EE 6360. Includes advanced topics in signal processing such as: Digital filter structures and finite-word-length effects, digital filter design and implementation methods, multirate digital signal processing, linear prediction and optimal filtering, spectral analysis and estimation methods. Prerequisite: EE 6360. Co-requisite: EE 6350. (3-0) T

EE 6362 Speech Signal Processing (3 semester hours) Introduction to the fundamentals of speech signal processing and speech applications. Speech analysis and speech synthesis techniques, speech recognition using hidden Markov models, speech enhancement and speech coding techniques including ADPCM and linear-predictive methods such as CELP. Prerequisites: EE 6350, EE 6360 and EE 6349. (3-0) T

EE 6365 Adaptive Signal Processing (3 semester hours) Adaptive signal processing algorithms learn the properties of their environments. Transversal and lattice versions of the Least Mean Squares (LMS) and Recursive Least Squares (RLS) adaptive filter algorithms and other modern algorithms will be studied. These algorithms will be applied to network and acoustic echo cancellation, speech enhancement, channel equalization, interference rejection, beam forming, direction finding, active noise control, wireless systems, and others. Prerequisite: EE 6349, EE 6350, EE 6360 and knowledge of matrix algebra (3-0) T

EE 6390 Introduction to Wireless Communications Systems (3 semester hours) Principles, practice, and system overview of mobile systems. Modulation, demodulation, coding, encoding, and multiple-access techniques. Performance characterization of mobile systems. MMIC and low-power mobile devices. Prerequisite: EE 4350 or equivalent. (3-0) Y

EE 6391 Signaling and Coding for Wireless Communications Systems (3 semester hours) Study of signaling and coding for mobile communication systems. Topics which will be covered include digital modulation schemes, digital multiple access technologies, their performance under wireless channel impairments, equalization, channel coding, interleaving, and diversity schemes. Prerequisites: EE 6352 and EE 6390. (3-0) T

EE 6392 Propagation and Devices for Wireless Communications (3 semester hours) Mobile communication fundamentals, models of wave propagation, simulation of electromagnetic waves in the cellular environment, multipath propagation, compensation for fading, mobile and cell antenna designs, problems of interference and incompatibility, design of active and passive cellular components, comparison of analog and digital cellular designs. Prerequisites: EE 4301 or equivalent, EE 6390. (3-0) T

EE 6394 Antenna Engineering for Wireless Communications (3 semester hours)

Operating principles for microwave antennas used in modern wireless communications systems. Prerequisite: EE 6316 or equivalent. (3-0) T

EE 6395 Advanced Radio Frequency Engineering (3 semester hours) Sources, components, antennas, and detectors used in wireless communication systems. Microwave-frequency component technology. Propagation paths and their effects on communications. Prerequisite: EE 5305 or equivalent. (2-3) R

EE 7340 Optical Network Architectures and Protocols (3 semester hours) Introduction to optical networks. The ITU Optical Layer. First-generation optical networks. Standards, e.g. SONET/SDH, FDDI. Second-generation optical networks. Broadcast and select networks. The lightpath concept. Wavelength routing networks. Virtual topology design. Photonic packet switching. Advanced solutions and testbeds. Prerequisite: EE 6340 (3-0) T

Computer Science Courses

CS 6352 Performance of Computer Systems and Networks (3 semester hours) Overview of case studies. Quick review of principles of probability theory. Queuing models and physical origin of random variables used in queuing models. Various important cases of the M/M/m/N queuing system. Little's law. The M/G/1 queuing system. Simulation of queuing systems. Product form solutions of open and closed queuing networks. Convolution algorithms and Mean Value Analysis for closed queuing networks. Stochastic Petri Nets. Discrete time queuing systems. Prerequisite: a first course on probability theory. (3-0) S

CS 6354 Advanced Software Engineering (3 semester hours) Introduction to software life cycle models and overview of their stages. System and software requirements engineering, software architecture and design, software testing, validation, and verification, software quality assurance and metrics, software generation, maintenance, and evolution, project planning, control, and management. Software processes, CASE tools, software reuse, reverse engineering, and re-engineering. Prerequisites: CS 5303, CS 5333; Corequisite: CS 5343 (CS 5343 can be taken before or at the same time as CS 6354) (3-0) S

CS 6360 Database Design (3 semester hours) Methods, principles and concepts that are relevant to the practice of database software design. Topics such as file-system organization, database structure, schemata, database implementation, information retrieval and protection. Prerequisite: CS 5343. (3-0) S

CS 6363 Design and Analysis of Computer Algorithms (3 semester hours) The study of efficient algorithms for various computational problems. Algorithm design techniques. Sorting, manipulation of data structures, graphs, matrix multiplication, and pattern matching. Complexity of algorithms, lower bounds, NP completeness. Prerequisite: CS 5343. (3-0) S

CS 6368 Telecommunication Network Management (3 semester hours) In-depth study of network management issues and standards in telecommunication networks. OSI management protocols including CMIP, CMISE, SNMP, and MIB. ITU's TMN (Telecommunication Management Network) standards, TMN functional architecture and information architecture. NMF (Network Management Forum) and service management,

service modeling and network management API. Issues of telecommunication network management in distributed processing environment. Prerequisite: One of CS 5390, CS 6390, or CS 6385. (3-0) Y

CS 6378 Advanced Operating Systems (3 semester hours) Concurrent processing, inter-process communication, process synchronization, deadlocks, introduction to queuing theory and operational analysis, topics in distributed systems and algorithms, checkpointing, recovery, multiprocessor operating systems. Prerequisites: CS 5348 or equivalent; knowledge of C and UNIX. (3-0) S

CS 6381 Combinatorics and Graph Algorithms (3 semester hours) Fundamentals of combinatorics and graph theory. Combinatorial optimization, optimization algorithms for graphs (max flow, shortest routes, Euler tour, Hamiltonian tour). Prerequisites: CS 5343, CS 6363. (3-0) T.

CS 6385 (TE 6385) Algorithmic Aspects of Telecommunication Networks (3 semester hours) This is an advanced course on topics related to the design, analysis, and development of telecommunications systems and networks. The focus is on the efficient algorithmic solutions for key problems in modern telecommunications networks, in centralized and distributed models. Topics include: main concepts in the design of distributed algorithms in synchronous and asynchronous models, analysis techniques for distributed algorithms, centralized and distributed solutions for handling design and optimization problems concerning network topology, architecture, routing, survivability, reliability, congestion, dimensioning and traffic management in modern telecommunication networks. Prerequisites: CS 5343, CS 5348 and TE 3341 or equivalents. (3-0) Y

CS 6386 Telecommunication Software Design (3 semester hours) Programming with sockets and remote procedure calls, real time programming concepts and strategies. Operating system design for real time systems. Encryption, file compression, and implementation of firewalls. An in-depth study of TCP/IP implementation. Introduction to discrete event simulation of networks. Prerequisite: CS 5390. (3-0) Y

CS 6390 Advanced Computer Networks (3 semester hours) Overview of the ISDN network and the SS7 protocol. High-speed networks including B-ISDN, Frame Relay and ATM. Congestion control algorithms, quality of service guarantees for throughput and delay. Prerequisite: CS 5390. (3-0) S

CS 6392 Mobile Computing Systems (3 semester hours) Topics include coping with mobility of computing systems, data management, reliability issues, packet transmission, mobile IP, end-to-end reliable communication, channel and other resource allocation, slot assignment, routing protocols, and issues in mobile wireless networks (without base stations). Prerequisite: 6378 or CS 6390 or equivalent. (3-0) Y

CS 6394 Digital Telephony (3 semester hours) Introduction and overview emphasizing the advantages of digital voice networks. Voice digitization. Digital transmission, multiplexing, and switching. Rearrangeable switching networks. Digital modulation for radio systems. Network operation issues: synchronization, control; integration of voice and data, packet switching and traffic analysis. (3-0) Y

CS 6396 Real-Time Systems (3 semester hours) Introduction to real-time applications and concepts. Real-time operating systems and resource management. Specification and design methods for real-time systems. System performance analysis and optimization

techniques, task assignment and scheduling, real-time communication, case studies of real-time operating systems. Prerequisite: CS 5348 or equivalent. (3-0) Y

Telecommunications Engineering Courses

TE 5341 Probability, Statistics, and Random Processes in Engineering (3 semester hours) Introduction to probability modeling and the statistical analysis in engineering and computer science. Introduction to Markov chains models for discrete and continuous time queuing systems in Telecommunications. Computer simulations. Prerequisite: Undergraduate degree in engineering and computer science. (3-0) Y

TE 6385 (CS 6385) Algorithmic Aspects of Telecommunication Networks (3 semester hours) This is an advanced course on topics related to the design, analysis, and development of telecommunications systems and networks. The focus is on the efficient algorithmic solutions for key problems in modern telecommunications networks, in centralized and distributed models. Topics include: main concepts in the design of distributed algorithms in synchronous and asynchronous models, analysis techniques for distributed algorithms, centralized and distributed solutions for handling design and optimization problems concerning network topology, architecture, routing, survivability, reliability, congestion, dimensioning and traffic management in modern telecommunication networks. Prerequisites: CS 5343, CS 5348, and TE 3341 or equivalents. (3-0) Y

TE 7V81 Special Topics In Telecommunications (1-6 semester hours) For letter grade credit only. (May be repeated to a maximum of 9 hours.) ([1-6]-0) S

TE 8V40 Individual Instruction in Telecommunications Engineering (1-6 semester hours) (May be repeated for credit.) For pass/fail credit only. ([1-6]-0) Y

TE 8V70 Research In Telecommunications Engineering (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) Y

TE 8V98 Thesis (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S

TE 8V99 Dissertation (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S