

**Course Descriptions for the Master of Communications Engineering
Program (Thesis Track)**

(A0827103) Information and Coding Theory (3 credits)

Probability Theory Review, Channel Capacity, Additive White Gaussian channel, Entropy, fundamental theorem of information theory, mutual information, Source Coding, Shannon- Fano coding, Linear Block Codes, Systematic Codes, Huffman Coding, Reed- Solomon, BCH, Convolutional Codes, Trellis coded modulation, Turbo Codes, Codes / Concatenated Codes, Interleaving of Codes, Decoding and Viterbi s Algorithms. Research Project

(A0827301) Wireless Communication Systems (3 credits)

Principles of modern mobile communication systems, mobile radio propagation channels, digital modulation, channel impairment mitigation techniques, multiple access technologies of modern mobile communication systems and networking, cell and frequency reuse, the evolution of modern cellular communication systems, i.e., from 2nd generation to 5th generation radio access networks. Research Project

(A0827401) Advanced Digital Communications (3 credits)

Signal space representation, Gram-Schmidt orthogonality procedure, Modulation techniques (BPSK, QAM, FSK, DFSK, OOK, MSK, and M-ary), Bandwidth and power spectrum analysis, Optimal MAP and ML receiver design, Probability of error analysis for generalized signal constellations, Rate efficient block communication, Capacity of AWGN channel, Combined coding and modulation, Error correction techniques for communication system design. Research Project

(A0827404) Data transmission and Computer Networks (3 credits)

Introduction to data communications, ISO reference model, electrical interface, synchronous and asynchronous transmission, local area networks (LAN), high speed and bridged local area networks IEEE 802.11, wide area networks (WAN), internetworking architecture (IPv4,IPv6), Broadband multiservice networks (FDDI-II)(ATM), application specific protocols (TCP/IP). Integration of data and cellular/wireless networks. Security issues. Research Project

(A0827501) Electromagnetic Wave Propagation (3 credits)

Time-varying electromagnetic wave propagation and reflection in different media, Propagation over flat earth, Propagation over spherical earth, Radio wave diffraction and knife edge model, Scattering and absorption of a wave by a single particle, Surface wave propagation, Ionospheric propagation, The effect of rain, snow, and ice on microwaves and millimeter waves, Millimeter-wave propagation. Research Project

(A0827701) Research Methodology (3 credits)

Meaning of research methodology, objectives of research, motivation in research, types of research and research approaches, significance of research, criteria of good research, defining the research problem, research design, sampling design fundamentals, measurement and scaling techniques, methods of data collection, processing and analysis of data, testing of Hypotheses, interpretation and report writing, computer role in research. Research Project

(A0827101) Probability and Random Processes (3 credits)

Concepts of random event, Introduction to probability, Discrete time space, Continuous time space, One dimensional random variables, Two and higher dimensional random variables, Structures of dependence, Conditional probability, Probability density functions, Transformations of density functions, Moment generating functions, Central limit theorem, Autocorrelation and stationarity, Ergodicity, Linear filters, Power spectral density. Research Project.

(A0827302) Antenna Theory and Design (3 credits)

Time varying fields, retarded potentials, Poynting's theorem, reciprocity, regions of reactive, transition, and far-field, Ideal dipole, Antenna parameters: directivity, gain, and aperture, Dipole and loop antennas, Antenna self and mutual impedance, matching techniques, travelling wave antennas, Broadband antennas, Equivalence principle, Aperture antennas, Balanced and unbalanced antennas, Antenna polarization, Feed structures, Antenna arrays, Software to model and simulate the antennas. Research Project

(A0827304) Engineering Optical Systems (3 credits)

General overview of the course. Optical fibers, Attenuation and dispersion, guided wave propagation, modes in optical fiber. Laser generation, semiconductor lasers. Light amplifiers and their applications. Optical modulation techniques. Multiplexing methods. Optical detectors and receivers, quantum efficiency, responsivity and bandwidth. Optical communication systems: optical modems, digital optical networks. Nonlinear optics and Soliton systems. Simulation techniques and practical aspects. Optical Sensors; Free Space Optics (FSO) and Light Fidelity (Li-Fi) Communication systems; Fiber deployments and the Internet of Things (IoT). Research Project.

(A0827403) Advanced Digital Signal Processing (3 credits)

Discrete time signal representation, Sampling theory, Quantization, z-transform, Discrete time Fourier transform DTFT, Discrete Fourier transform DFT, Fast Fourier transform FFT algorithm. System frequency response, Solving difference equations, Discrete system analysis via MATLAB. Digital filter design criteria. Direct form, cascade form and parallel form for both FIR and IIR, Practical FIR filter implementation, Hamming, Blackwell and Kaiser Windows for FIR filter design. Digital filter implementation on MATLAB. Research Project

(A0827502) Satellite Communications (3 credits)

Introduction to Satellite Communications, Satellite Link Design; Transmission Theory, System Noise Temperature and G/T Ratio, Uplink and Downlink design, Modulation and Multiplexing Techniques for Satellite Links, Multiple Access, Error Control for Digital Satellite Links; Linear and Cyclic Block Codes; Convolutional Codes, Concatenated Coding and Interleaving, Propagation Effects and their Impact on Satellite-Earth Links, Direct Broadcast Satellite Television and Radio. Research Project.

Special topics in Communications (A0827601) (3 credits)

Subjects to be specified when course is offered.

Thesis (A0827702) (9 credits)