

605. ELECTRONICS AND COMMUNICATION ENGINEERING (EC)

Combinational Circuits, Sequential Circuits, Memory Devices: Latches and flip-flops, excitation tables, characteristic equations, state diagram, Finite State Machines (FSM), Algorithmic State Machine (ASM) Charts and Programmable Logic Devices.

CMOS Technology, Designing circuits using CMOS, Static CMOS Design, Dynamic CMOS Design, Data Path Design, Semiconductor Memory Design, Interconnect Design and Crosstalk.

Small signal and Large signal models of BJT and MOSFET, CMOS current mirror, common source amplifier, source follower, two-stage MOS Operational amplifier, Op-amp based comparators, sample and hold circuits, Phase locked loops.

Review of Microprocessors and their features, 8051 Microcontroller: Architecture, Instruction Set, Interrupt Programming and Interfacing and Embedded System: Architectures, Challenges and Trends of Embedded Systems and overview of Real Time Operating Systems (RTOS).

Basic Concepts of Networking and Switching, Networking Configurations, OSI and TCP/IP Architectures, Circuit Switching and Packet Switching, Routing Algorithms and IEEE 802.11.

Wireless channel statistical models, BER performance in AWGN and fading channels, Diversity Reception, Channel Coding Gain, Linear Convolution Encoders, Viterbi Decoding Technique for Convolution Codes- Soft / Hard Decision, Turbo Encoder, BCJR Algorithm, MIMO Systems, MIMO fading channels, Alamouti Scheme.

Digital Signal Processing: FIR filters, IIR filters, Design of filters, Multi-rate Signal Processing, Applications of Multi-rate Signal Processing, Digital filter banks, Short Time Fourier Transform, Gabor Transform, Haar Wavelet.

Adaptive filter theory: filtering, smoothing and prediction, Principle of Orthogonality, LMS gradient algorithm, convergence of LMS algorithm, Adaptive noise cancelling, Adaptive beam forming, Kalman filter and Vector Kalman filter formulation. Phase lead, phase lag and PID Controllers.

Classical Spectral Estimation, Correlogram and periodogram methods of Power Spectral Density (PSD) estimation, Auto regressive (AR), Moving average (MA) and Auto regressive moving average (ARMA) random Process Models, AR Spectral estimation and Implementation of MA Spectral estimator.

Digital Models for Speech, Short-time period Analysis, Digital Speech representation and Coding, Pulse Coded Modulation (PCM), Adaptive PCM and Delta Modulation, Linear Prediction Coding Analysis, Automatic Speech Recognition: Hidden Markov Models (HMM) for speech recognition and its Forward and Backward algorithms.

Elements of Digital Image Processing Systems, Image Transforms: FFT, Haar transform and Discrete Cosine Transform (DCT). Image Enhancement: Spatial and Frequency domain techniques. Image Compression: Lossless and lossy compression models.

Global Position System (GPS): principle of Operation, Operating Frequencies, Orbits, GPS Signals, Signal Structure, C/A Code and P-Code, GPS Error Models, GLONASS, Galileo and IRNS System.

Maxwell's equations: Wave equation, plane waves in lossless and lossy media, duality, Uniqueness, Image theory, equivalence principle, Induction and Reciprocity theorems, plane wave functions, general solution of wave guide, Rectangular and Circular wave guides.

Microwave Devices and circuits: one port junction, terminal voltage and currents in multiport junctions, Poynting's energy theorem, Normalized waves and scattering matrix, E and H Plane tee, Directional coupler, Microwave propagation in ferrites, Principles of Faraday rotation, S-matrix of non reciprocal devices, Broad band matching, multi-section quarter wave transformers.

Antenna parameters: theories of radiation, equivalence theorem, image theory, lense and reflector antennas, log periodic antennas, linear arrays, Printed antennas: Rectangular and circular patch antenna design and Antenna measurements.

Hybrid Microwave Integrated Circuits (MIC): Monolithic MIC technology, analysis of strip line and micro-strip line, theory of coupled micro-strip directional couplers, branch line couplers, lumped elements for MIC design.

Radar fundamentals: Noise and false alarms, Detection of one sample of signal with noise, integration of pulse trains, detection of fluctuating targets, CFAR, loss factors in detection, Definition of radar cross section, Radar cross section of simple and complex objects, Doppler Effect, CW and FMCW radar, Airborne Doppler Navigation, Non-coherent MTI radar, different types of tracking techniques, atmospheric effects of radar.