RAM KRISHNA DHARMARTH FOUNDATION UNIVERSITY, BHOPAL

Ph.D. Entrance Exam
Subject: Electronics and Communication Engineering
Syllabus

Basic Electronics:
Diode, basic structure and operating principle, Diode Applications, rectifier circuits (half-wave and full-wave rectifiers, rectifiers with capacitor filter), voltage regulator (using Zener diode),Bipolar Junction Transistors(BJT) and their Applications, structure BJT as an amplifier, BJT as a switch, MOSFET, their structures and principle of physical operation MOSFET as an amplifier, MOSFET as a switch.

Amplifiers: Differential and operational amplifier and its applications, common mode rejection ratio, typical op-amp specifications (open loop gain, differential input resistance, unity gain-bandwidth etc.), Functionality, specifications (voltage gain, current gain, input resistance, output resistance, dynamic range, bandwidth, linearity, power efficiency etc.).

Filters: Passive & Active filters, Low pass, high pass, band pass and band stop filters.
Feedback: Basic concept of negative and positive feedback, application of negative feedback in amplifiers, effect on gain, bandwidth, input resistance, output resistance and desensitivity to parameter variations.
Oscillators: Barkhausen criterion, sinusoidal and non-sinusoidal oscillators, applications and typical circuits.
Power electronics: Half wave and full wave rectification, filtering, regulation with zener diode and linear regulators, switched mode power supply.
Digital electronics: Review of Boolean algebra and signed number representation schemes in binary, implementation of Boolean functions using various logic gates, concept of combinatorial and sequential circuits, registers and counters.
Books Recommended:-
[1] Robert L Boylested & Louis Nashelsky Electronics Devices and Circuit Theory, 2/e Indian Reprint LPC, Pearson Education pvt Ltd. 2002.
[2] J.B.Gupta, Electronics Devices and Circuit, Second edition,   SK Kataria & Sons Pvt. Ltd.,2006

Network Theory:
Development of the Circuit concept, Network equations, Initial conditions, Fourier transform and Laplace transform. Transient and steady state response of RC, RL and RLC circuits using Laplace transform. Basic definitions loop (or tie set), cut-set, mesh matrices and their relationships, applications of graph theory in solving network equations. Network functions, concepts of poles and zeros. Impulse response and convolution. Bode   plots.   Two-Port networks, network parameters, *z* parameters, *y* parameters, *h* parameters, *ABCD* matrix, Transmission matrix.
Books Recommended:
[1] Van Valkenburg M.E., Network Analysis,3/e,PHI, 2001.

CONTROL SYSTEMS:
Basic control system components, block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems, Mason's Gain formula, Steady-state error & error constants, Routh-Hurwitz criterion, Bode and Nyquist plots.
Books Recommended:
[1] Nagrath & Gopal, Control System Engineering, 5/e PHI, New age Publishers 2007
[2] B.C. Kuo, Automatic Control System, Seventh edition,   PHI,2006

Communication Systems
Basic Communication system, Line, wireless or Radio communication. Basic concept of Signals and Classifications of signals.
Analog Communication:
Analog signals, Concepts of modulation and Demodulation Hilbert transform and phase   shifting, Continuous wave (CW) modulation, AM, DSB/SC, SSB, VSB, methods of generation, Demodulation

techniques of CW modulation, Nonlinear modulation techniques, FM and PM, methods of generation, Time-division multiplexing, Performance of analog modulation schemes in AWGN, CNR, post- demodulation SNR and figure of merit for AM, DSB/SC, SSB, FM, threshold effect in FM. Noise in receivers, Noise figures.

Digital Communication: Digital communication systems, Digital signals and their spectra, Concepts of information and entropy, Source coding, Coding theorem. Quantization of signals, Waveform coding techniques, PCM, DPCM, ADPCM, DM, ADM, Baseband transmission, inter symbol interference, noise, eye pattern, BER analysis, Optimum filtering, equalization techniques, Digital modulation schemes, Binary modulation schemes- ASK, PSK, FSK, DPSK, M-ary modulation schemes, QPSK, $\pi/4$ QPSK, MSK, QAM, generation and demodulation schemes, carrier recovery techniques, BER analysis of digital modulation systems, Shannons capacity theorem and spectral efficiency of digital modulation schemes.

Books Recommended:

[1] John G. Proakis & Masoud Salehi Fundamentals of Communication systems, 8/Impression Pearson Education ,2012

[2] Sanjay Sharma, Communication systems(Analog & Digital),3/e SK Kataria & Sons Pvt.   Ltd,2005

Signals and Systems

Introduction of Signals & Systems, Linear time invariant systems and their properties, continuous time and discrete time systems, Causality, stability, region of convergence. Laplace transform, z-transform, ROC and their properties, Inverse Z-transforms, discrete Fourier transform its properties, Efficeient computation of DFT z-transforms, IIR and FIR System.

Concepts of linear vector space and orthogonal signal representation. Discrete signals, Sampling, digitization and reconstruction of analog signals, Random variables and processes, stationary, ergodicity, correlation functions, power density spectra, Basic concept of optimum filtering, Wiener Hopf filter.

Books Recommended:-

[1] Sanjay Sharma, Signal & Systems, 5/e SK Kataria & Sons Pvt. Ltd,2006

Digital Signal Processing

Signal, Systems and Signal Processing, Review of discrete time signals and systems - causality, stability, discrete time Fourier transform, sampling and z-transform. Introduction to signal space, orthogonal basis and signal representation using unitary transforms like DFT,DCT, Haar and Walsh Hadmard transform, Properties of DFT, circular convolution, linear convolution using DFT, overlap add and save methods, FFT. Filter structures for IIR and FIR filters, linear phase FIR filters. Digital filter design techniques, IIR filter design.

Books Recommended:-

[1] Oppenheim and Schafer, Discrete time signal processing, 2/e PHI,2005

[2] Proakis and manolakis, Discrete time signal processing,   PHI,2005

[3] Sanjay Sharma, Digital Signal Processing, 2/e SK Kataria & Sons Pvt.   Ltd,2006

Electromagnetic Engineering:

Maxwell's equation and their applications, displacement current, equation of continuity, boundary conditions, propagation of uniform plane waves in unbounded medium, reflection, refraction, phase and group velocities.

Microwave Techniques and Antenna: Basics of TE, TEM & TM Waveguides, Parallel Plate waveguide, rectangular waveguides and Circular waveguide, boundary conditions, cut-off frequencies, dispersion relations. Basics of propagation in dielectric waveguide.

Basics of Antennas, Dipole antennas, half-wave dipole, antenna gain, pattern multiplication, radiation pattern like isotropic, directional and omnidirectional and their parameters,

Books recommended:

[1] Samuel Y. Liao, Microwave Devices and Circuits, 3/e, Prentice Hall of India-2003

[2] K.D. Prasad, Antenna and Wave Propagation, 3/e, reprint-2007, Satya prakashan, New   Delhi.

Artificial intelligence:

Artificial Neural Network, Fuzzy systems, Neuro-fuzzy systems and genetic algorithms, Simulation tools used in electronics and communication Engineering.

Books recommended:

[1] S. Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, 13 Printing, PHI-2010