National Institute of Technology, Jamshedpur
Department of Electronics & Communication Engineering

B.Tech.(H) Course Revised Syllabus

SEMESTER III

Engineering Mathematics-III

Unit 1

Laplace Transform: Concept of Laplace Transform & its properties(Definition of Laplace Transform, Linearity property, condition for existence of Laplace Transform; First & Second Shifting properties), Laplace Transform of derivatives and integrals; Unit Step functions Dirac delta function. Differentiation and Integration of transforms, Convolution Theorem, Inversion, Periodic functions, Evaluation of integrals by L.T, Solution of boundary value problems

Unit 2

Z- Transform: -Definition of Z-Transform and its properties, Initial and Final Value theorem, Convolution theorem, Evaluation of Inverse Z- Transform, Concept of difference equation, Application to difference equation

Unit 3

Fourier series: Fourier series and its convergence, Euler's coefficients, Drichlet's condition, Change of interval, half range series, Complex form of Fourier series

Unit 4

Fourier Transform: Fourier Integral formula, Fourier Transform, Fourier sine and cosine transforms, Linearity, Scaling, frequency shifting and time shifting properties, Self-reciprocity of Fourier Transform, Convolution theorem. Application to boundary value problems

Unit 5

Probability and Statistics:- Definition and Laws of Probability, Baye's rule, discrete and continuous random variables, cumulative distribution function, probability mass function, probability density function , mathematical expectation, mean variance, moment generating function and characteristic function, standard probability models-Binomial, Poisson and Normal, Sampling distributions: Chi-square and t distributions

Textbooks:

1. Higher Engineering Mathematics by Dr. B.S. Grewal

Reference book:

1. Advanced Engineering Mathematics by Erwin Kreyszig

Signals and Systems

Unit 1

Introduction: Continuous time and discrete time systems, Properties of systems, linear time invariant systems, continuous time and discrete time, Properties of LTI systems and their block diagrams. Convolution, Discrete time systems described by difference equations

Unit 2

FourierSeries Representation of Signals: Fourier series representation of continuous periodic signal & its properties, Fourier series representation of discrete periodic signal & its properties, Continuous time filters &discrete time filters described by Diff. equation.

Unit3

Fourier Transform: The continuous time Fourier transform for periodic and aperiodic signals, Properties of CTFT. Discrete time Fourier transform for periodic and aperiodic signals, Properties of DTFT, The convolution and modulation property, Properties of, DFT and FFT

Unit 4

Z-Transform & LaplaceTransform: Introduction. The region of convergence for the Z-transform, The Inverse Z-transform, two-dimensional Z-transform, Properties of Z transform, Laplace transforms, Properties of Laplace Transform, Application of Laplace transform to system analysis.

Unit 5

Sampling: Mathematical theory of sampling, sampling theorem, Ideal & Real sampling, Interpolation technique for the reconstruction of a signal from its samples, Aliasing, Sampling in freq. Domain, Sampling of discrete time signals.

BOOKS:

1. Principles of Linear Systems and Signals, Oxford
2. Signal & Systems 3e, Chen 3rd, Oxford
3. Fundamentals of Signals and Systems, Wiley
4. Signals and Systems, P Rao, TMH

Electromagnetic Engineering

Unit 1

Coordinate System and Vector Calculus: Cartesian coordinate, Cylindrical Coordinates, Spherical Coordinates, Inter Coordinate Transformation, Differential length, Area and Volume, Line, Surface and Volume Integrals, Divergence Theorem, Stokes's Theorem

Unit 2

Time Varying Fields and Maxwell's Equation: Gauss's law, Poisson's and Laplace's Equations, Ampere's Circuit Law, Magnetic Flux Density, Faraday's Law, Introduction of Maxwell's equations in point form and integral form, conversion of one form of Maxwell's equations on other form, displacement current, equations of continuity for time varying field.

Unit 3

Boundary Conditions: Fields in Media and Boundary Conditions, Boundary Conditions for Dielectric and Dielectric, Conductor and Dielectric, Conductor and Free Space.

Unit 4

Electromagnetic Fields: The wave equation, General form of wave equation for perfect dielectric conditions, Wave propagation in lossy dielectric medium, Wave propagation in good dielectrics, good conductor, Lossless dielectric and in free space. Power flow and pointing vector, Refection of uniform plane waves by perfect dielectric - Normal incidence, Oblique incidence.

Unit 5

Transmission Lines: Introduction; Line equations, Evaluation of propagation constant, Phase constant, Phase Velocity and characteristic impedance for lossless line and distortion less line, Design concept, Power handling capacity, Smith chart, The Terminated lossless line, Group Velocity, Dispersion.

TEXTBOOK(S):

1. Sadiku Matthew N.O. "Elements of Electromagnetic", 6th Edition, Oxford University Press, ISBN: 0199321388, 9780199321384, 2014.

REFERENCE BOOK(S):

1. Harrington R.F. "Time Harmonic Electromagnetic Fields", Volume 32 of IEEE Press Series on Electromagnetic Wave Theory, John Wiley & Sons Inc., 2001, ISBN: 047120806X, 9780471208068.

2. Pozar D.M. "Microwave Engineering", Fourth Edition, John Wiley & Sons Inc., 2012, ISBN: 978-0-470-63155-3.

Network and Systems

Unit 1

Kirchhoff's Current and Voltage Laws, Independent and dependent sources and their interconnection, and power calculations. Network analysis: Mesh, Super mesh, Node and Super Node analysis, Source transformation and source shifting, Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems, Millers Theorem and its dual.

Unit 2

Initial conditions, source free RL and RC circuits, properties of exponential response, Driven RL and RC circuits, Natural and Forced response of RL and RC circuits. Introduction to Source free and driven series RLC circuit. Over-damped and under-damped series RLC circuit

Unit 3

Significance of Quality factor, Series Resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity, Effect of R_g on BW & Selectivity, Magnification factor, Parallel resonance: Resonant frequency and admittance variation with frequency, Bandwidth and selectivity. General case: Resistance present in both of branches, Comparison and applications of series and parallel resonant circuits.

Unit 4

Terminal characteristics of network: Z, Y, h, Transmission Parameters; Reciprocity and symmetry conditions, Applications of the parameters, Application of Laplace Transforms in circuit analysis. Network functions for one port and two port networks, Pole-zeros of network functions and network stability

Unit 5

Network graph, tree, co-tree, loops, incidence matrix, tie-set, cut-set matrix, Formulation of Equilibrium equations in matrix form, solution of resistive networks and principle of duality, Classifications: Symmetrical and Asymmetrical networks. Properties of two port network: Symmetrical Networks (T and π only), Z_0 and γ in terms of circuit components, Asymmetrical Networks: Image Impedance and Iterative Impedance (L-Section only). Filters: Filter fundamentals, Constant K-LPF, HPF, BPF and BSF

Textbooks:

1. William H Hayt, Jack E Kimmerly and Steven M. Durbin, Engineering Circuit Analysis, Tata
   McGraw Hill
2. D Roy Choudhury, Networks and Systems, New Age International Publishers
3. M. E. Van Valkenburg, Network Analysis, PHI / Pearson Education
4. Franklin F. Kuo, Network analysis and Synthesis, Wiley International Edition

Solid State Electronics

Unit 1

Transistor – Biasing – Stability – Thermal runaway. Transistor As an amplifier – RC coupled amplifier, Frequency Response, Gain Bandwidth relation – Cascading of transistors – cascade Darlington pair – emitter follower

Unit 2

FET, FET amplifier – MOSFET, depletion and enhancement type – source drain characteristics and transfer characteristics

Unit 3

Oscillators – Concept of feed-back – Transistorised phase shift oscillator – wien bridge Oscillator – Hartley Oscillator – Colpits Oscillator (Operation and Expression for frequency)

Unit 4

Clipping, Clamping, Integration, Differentiation – Astable, Bistable and Monostable Multivibrators – Sweep generators, Simple Bootstrap sweep generators

Unit 5

Power supplies & Special semiconductor devices – Regulator power supplies – IC regulated Power supplies, 7805, 7905, LM317 – LED, LCD, Photodiode, Photo transistor, opto-coupler. Seven segment display, SCR, UJT (basic concepts only), DIAC, TRIAC

REFERENCES:

1. Integrated Electronics – Millman and Halkias, McGraw Hill
2. Pulse Digital and Switching wave forms – Millman and Taub, McGraw Hill
3. Electronics Devices & Circuits – Boylsted & Neshelsky, Pearson Education

Data Structures and Program Design

Unit 1

Algorithms and Analysis of Algorithms: Introduction: Basic concept of data, structures and pointers, Data Structure Classification, Efficiency of Algorithms.

Unit 2

Arrays, Stacks and Queues: Array Operations, Number of Elements in an Array, Representation of Arrays in Memory, Applications of Array, Stack-Introduction, Stack Operations, Applications of Stack,

Queues-Introduction, Operations on Queues, Circular Queues, Other Types of Queues, Applications of Queues.

Unit 3

Linked List, Linked Stacks and Linked Queues: Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Multiply Linked Lists, Applications of Linked Lists, Introduction to Linked Stack and Linked Queues, Operations on Linked Stacks and Linked Queues, Dynamic Memory management and Linked Stack, Implementations of Linked Representations, Applications of Linked Stacks and Linked Queues.

Unit 4

Trees, Binary Trees, BST, AVL Trees and B Trees: Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees: Basic Terminologies and Types, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Applications, BST & AVL Trees: Introduction, BST: Definition and Operations, AVL Trees: Definition and Operations, B Trees: Introduction, m-way search trees: Definition and Operations, B Trees: Definition and Operations.

Unit 5

Graphs: Introduction, Definitions and Basic Terminologies, Representations of Graphs, Graph Traversals, Single-Source Shortest-Path Problem, Minimum Cost Spanning Trees. Introduction, Binary Search, Transpose Sequential Search, Interpolation Search. Sorting and Searching: Different sorting techniques. Insertion sort, selection sort, bubble sort, radix sort, quick sort, merge sort, heap sort.

Textbooks:

1. Horowitz and Sahni, **Fundamental of Data Structures**, 4th Ed., CSP, 1994, (Pascal, C, C++ or Generic version)
2. Kruse, Tondo and Leung, **Data Structures and Program Design in C**, 2nd edition, Prentice-Hall, 1997.

References:

1. Knuth, D. E. **The Art of Computer Programming**, Vol. I & III, Addison-Wesley, 1974. These books must be read by any serious student of computer science.
2. Carrano, F. M., **Data Abstraction and Problem Solving with C++**, Benjamin Cummings, 1995.
3. Horowitz, E., Sahni, S. and Mehta, D., **Fundamentals of Data Structures in C++**, W.H. Freeman, 1995.
4. Standish, T. A., **Data Structures, Algorithms and Software Principles in C**, Addison-Wesley, 1995.

SEMESTER IV

Digital Circuits and Systems

Unit 1

Number System, Binary Codes and Boolean Algebra: Positional Number System: Binary, Octal, Decimal, Hexadecimal number system, Number base conversions, complements - signed magnitude binary numbers–Binary Arithmetic-addition, subtraction-Binary codes- Weighted, BCD, 8421, Grey code, Excess3code, ASCII, Boolean postulates and laws with proof, De-Morgan's Theorems, Principle of Duality, Logic gates and Boolean Algebra

Unit 2

Boolean function representation and minimization techniques: Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS), Canonical forms, Karnaugh-map Minimization, don't care conditions, Tabular Method

Unit 3

Combinational Logic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Full adder using half adder, Multipliers. Multiplexer/de-multiplexers, Encoders and Decoders

Unit 4

Sequential Logic Circuits: Latches, Flip Flops, SR, D, JK, Master slave JK, Excitation tables, conversion of Flip Flops. State Diagrams. Counters, Synchronous and Asynchronous counters, Up/Down Counters, Cascaded Counters, Counter applications. Registers, Shift register functions, Serial in/serial out shift registers, serial in parallel Registers, Shift register functions, Serial in/serial out shift registers, serial in parallel out/shift registers, Parallel In/ Parallel out shift registers, Shift register Applications

Unit 5

Digital Logic Families and Memory Elements: TTL, RTL, DTL, ECL, NMOS/ CMOS (circuit operation, I/O characteristics, fan-outs, noise margin, and propagation delay time), Memory Elements – ROM, PROM, RAM, SRAM, DRAM

TEXTBOOK(S):

1. Donald D Givone, Digital Principles and Design", Tata McGraw Hill, 2003
2. Donald P Leach, Albert Paul Malvino, Digital Principles and Applications", Tata McGraw Hill 6th edition, 2006

REFERENCE BOOK(S):

1. M. Morris Mano, "DigitalDesign", Pearson Education Asia.

Antennas and Wave Propagation

Unit 1

Antenna Fundamentals: Introduction, Types of Antennas, Radiation Pattern and mechanism, Antenna Parameters, Antenna Losses, Duality Theorem, Reciprocity Theorem

Unit 2

Elementary Antennas: Linear Wire Antennas, Monopole, Infinitesimal Dipole, Small Dipole, Finite Length Dipole, Half Wavelength Dipole, Loop Antenna, Small Circular Loop.

Unit 3

Aperture and Broadband Antennas: Huygens' Principle, Radiation from Rectangular and Circular Apertures, Babinet's Principle, E-Plane and H-Place Sectorial Horn, Pyramidal Horn, Conical Horn, Broadband Antennas.

Unit 4

Microstrip Antennas: Basic Characteristics of Microstrip Antennas, Antenna Miniaturization, Feeding Methods, Introduction to Patch and its types, Methods of Analysis, Design of Rectangular and Circular Patch Antennas. Quality Factor, Bandwidth, Efficiency.

Unit 5

Reflector and Smart Antennas: Plane, Corner, Parabolic and Spherical Reflector, Introduction to Smart Antennas, Switched Beam Systems, Adaptive Array Systems, Spatial Division Multiple Access, MANETs.

Textbook(S):

1. Balanis C.A., "Antenna Theory and Design", 3rd Edition, John Wiley & Sons, 2005, ISBN: 978-81-265-2422-8.

Reference Book(S):

2. Stutzman W.L., and Thiele G.A., "Antenna Theory and Design", 2nd Edition, John Wiley & Sons, 1998.
3. Elliot R.S., "Antenna Theory and Design", Revised Edition, Wiley-IEEE Press, 2003.

Analog Communication

Unit 1

Introduction to Fourier Series and Fourier Transform; Energy and Power Spectral Densities; Introduction of communication, Elements of Communication System-Transmitters, transmission channels and receivers; Concepts of modulation and need for modulation.

Unit2

Amplitude modulation (AM): - Time domain expression of baseband signal; modulation index, frequency domain (spectral) representations, phasor diagram, AM transmission bandwidth; AM for a single tone message- carrier and side band components; Transmission requirements for AM, normalized power and side band power. Double side band suppressed carrier modulation (DSB-SC) - time and frequency domain expressions; Transmission requirements for DSB, bandwidth and transmission power for DSB-SC; Generation of DSB-SC, square law modulators, balanced modulators, ring modulators, switching modulators. Single side band modulation (SSB): -Basic concept, SSB with suppressed/reduced carrier, advantages and generation of SSB; transmit band width and power, side band filter examples; Vestigial side band modulation (VSB)- Basic concept and application

Unit3

Demodulation of AM signals- square law and envelope detectors; The super heterodyne receiver for standard AM radio; Synchronous demodulation of AM, DSB and SSB using synchronous detection, Effects of frequency and phase errors in the local oscillator in DSB and SSB Demodulation of SSB with pilot carrier, use of SSB in telephony. Phase-Locked Loop (PLL):- Carrier recovery circuits, Basic operation of PLL, mathematical analysis, applications.

Unit4

Angle Modulation (FM/PM): Instantaneous frequency instantaneous phase, time domain representation for FM and PM; Narrow band angle modulation with frequency and phase, modulation index, Phasor diagram; FM and PM signals for a single tone message, spectral representation, power and effective bandwidth; Generation of wide band FM using Armstrong method, commercial FM requirements. Detection of FM and PM signals, limiter discriminator; Demodulation of PM using PLL; FM broadcasting and stereo FM radio.

Unit5

Noise Performance of Analog Communication Systems: Signal-to-noise ratio (SNR) in linear modulation, synchronous detection of DSB; SNR for AM, DSB and SSB; comparison of DSB, SSB and AM; Effect of noise in envelope and square law detection of AM, threshold effects in nonlinear detectors; SNR for FM, SNR improvement using pre-emphasis and de-emphasis. FM threshold effects; Comparison of linear and exponential modulation system for additive white band-limited noise channels.

Textbooks:

1. S. Haykin, "Communication Systems", Wiley India Edition, 2009.
2. B. P. Lathi, Z. Ding "Modern Digital and Analog Communication Systems", Oxford University Press, 2010.

References Books:

1. J. G. Proakis and M. Salehi, "Communication Systems Engineering", Pearson Education, 2002.
2. R. P. Singh and S. D. Sapre "Communication Systems", Tata McGraw-Hill Education, 2008.

Analog Electronics

Unit 1

Diode and transistor: Common Emitter and Emitter follower analysis and comparison using hybrid equivalent circuit - Considerations in cascading transistor amplifiers- Class B and Class AB - Power amplifiers using BJT/FET: Biasing a JFET and MOSFET - Small signal model - CS and CD amplifiers, Frequency response of BJT amplifiers. Concepts of negative and positive feedback – loop gain-advantages of negative feedback -Feedback Connection Types - Practical Feedback Circuits

Unit 2

Op amp basics and linear applications: Introduction Block diagram representation of a typical op-amp, Analysis op-amp ICC circuits, types, designations, packages, pin configurations and power supplies. Ideal op-amp, equivalent circuit, open loop op amp configurations of differential, inverting and non-inverting amplifiers, op amp feedback amplifier analysis, differential amplifier with one, two and three op amps. Op-amp parameters - offset voltages and currents, bias current, drift, PSRR, CMRR, offset nulling methods

Unit 3

AC performance of O-amp: Bandwidth, slew rate and frequency response. Op-amp applications: DC and AC amplifiers, peaking, summing scaling and averaging amplifiers, instrumentation amplifier, differential input and differential, output amplifier, V to I and I to V converters, integrator, differentiator comparator, non-linear amplifier, phase shift oscillator, Wien bridge oscillator, square, triangular and sawtooth wave generator, voltage controlled oscillator, zero crossing detector, window detector, introduction to analog simulation

Unit 4

Non-linear IC applications using op-amp: Signal Generators: Square, triangle and ramp generator circuits using op amps - Effect of slew rate on waveform generation- monostable circuits- Principles of VCO circuits. Comparator Circuits: Zero Crossing Detector- Regenerative comparator circuits Active filters –Types- Characteristics- Frequency Response of different types of filters- Order and cut off

frequency -Butterworth low pass filter – First order and second order filter design - Sallen and Key second order LP filter, Butterworth high pass filters - Second order wide band and narrow band filters.

Unit 5

Timer IC 555: Functional diagram stable and monostable modes Phase locked loops: Principles – Building blocks of PLL-Lock and Capture ranges - Capture process - Study of NE565 - Applications of PLL - Frequency multiplication - FSK demodulator - FM demodulation. Three terminal regulator ICs: basic block schematic - 78 x x& 79 x x series - Adjustable output voltage regulator LM 317, LM 340 and LM 337 series power supply ICs, their use and basic design considerations for designing regulated power supplies

Reference Books:

1. Robert T. Paynter, Introductory Electronic Devices and Circuits, Pearson Education
2. A. V. Boylsted and Neshelsky, Electronic Devices and Circuits, Prentice Hall of India
3. Ramakant A Gayakwad, Op- Amps and Linear Integrated Circuits, Prentice Hall of India
4. Schilling and Belove, Electronic Circuits, McGraw Hill
5. Theodore F. Bogart Jr., Electronic Devices and Circuits,
6. K. R. Botkar, Integrated Circuits, Khanna Publishers
7. Floyd, Fundamentals of Analog Circuits 2e, Pearson Education

Control Systems

Unit 1

The Control System: Open loop & closed control; servomechanism, Physical examples. Transfer functions, Block diagram algebra, and Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback

Unit 2

Time Response analysis: Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants, Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems, performance indices

Unit 3

Control System Components: Constructional and working concept of ac servomotor, synchronous and stepper motor, Stability and Algebraic Criteria concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations. Root Locus Technique: The root locus concepts, construction of root loci.

Unit 4

Frequency response Analysis: Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, constant M&N circles

Unit 5

Introduction to Design: The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain. Review of state variable technique: Review of state variable technique, conversion of state variable model to transfer function model and vice-versa, diagonalization, Controllability and observability and their testing

Textbooks:

1. Nagrath & Gopal, "Control System Engineering", New-age International.
2. K. Ogata "Modern Control Engineering", Prentice Hall of India
3. B.C. Kuo & Farid Golnaraghi, "Automatic Control System" Wiley India Ltd.
4. D. Roy Choudhary "Modern Control Engineering", Prentice Hall of India

Reference Books:

1. Norman S. Mise, Control System Engineering, Wiley Publishing Co.
2. Ajit K Mandal, "Introduction to Control Engineering" New Age International.
3. R.T. Stefani, B. Shahian, C.J. Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
4. Samarjit Ghosh, "Control Systems theory and Applications", Pearson Education

SEMESTER -V

VLSI Design

Unit 1

Basic n-well CMOS Process, P-well process, Twin-tub process, Silicon on insulator, CMOS process enhancements, Metal interconnect, Polysilicon/refractory metal interconnect, Local interconnect, Circuit elements like resistors, Capacitors, EAROM, Bipolar transistors and thin film transistor.

Unit 2

Behavioural, structural and physical representation, Example of a triangular waveform generator and its behavioural, Structural and physical description. Layout Design Rules: Layer representations, CMOS n-well rules, Design rule backgrounder, Layer assignment, Latch-up problem, Latch-up triggering, Internal latch-up prevention techniques, Resistance estimation, and Capacitance estimation.

Unit 3

MOS Capacitor, MOS Transistor theory, C-V characteristics, Non ideal I-V effects, Technology Scaling. CMOS inverters, DC transfer characteristics, Power components, Power delay product, Transmission gate, CMOS combo logic design. Delays: RC delay model, Effective resistance, Gate and diffusion capacitance, Equivalent RC circuits; Linear delay model, Logical effort, Parasitic delay, Delay in a logic gate, Path logical efforts.

Unit 4

Invertor, NAND and NOR gates, Complex logic gates layout, CMOS standard cell design, Gate array layout, Sea-of-gates layout, General CMOS logic gate layout guidelines, Layout optimisation for performance, Transmission gate layout consideration, 2-input multiplexers, I/O structures, V_{DD} and V_{SS} pads, Output & input pads, Tri-state and bi-directional pads, Miscellaneous pads

Unit 5

Current sink and source, Current mirror, Active load, Current source and Push-pull inverters, Common source, Common drain, Common gate amplifiers, Cascode amplifier, Differential amplifier, Operational amplifier, OP Amp design, OP Amp as a comparator, Sample and hold, Analogue layout considerations, Transistor layouts, Centroid design, Capacitor matching, Resistor layout, Noise consideration

Textbooks:

1. "Principle of CMOS VLSI Design A System Perspective", Weste Neil H E & Eshraghian K, Pearson Education, 1993(for unit-1,2,4)

2. "Analogue Integrated Circuits Design", Johns D and Martin K, John Wiley & Sons, 1997(unit 5).

3. Charles H. Roth, "Digital systems design using VHDL", PWS. (unit 3)
4. Wyane Wolf, "Modern VLSI Design (System on Chip)", PHI Publication.

Reference books:

1. Allen Holberg, "Analog CMOS Design", Oxford University Press.
2. Neil H. E. Weste, David Money Harris, "CMOS VLSI Design: A Circuit & System Perspective", Pearson Publication.

Digital Communication

Unit 1

Introduction of Digital Communications, Block Diagram of Digital Communication System; Information Theoretic Approach to Digital Communications; Digital Communication Blocks Realized as Software-Defined-Radio

Unit 2

Probability and Random processes: Review of Probability and Random Variables-Sample Space, Events and Probability, Joint and Conditional Probability, Introduction to Random Variables, CDF, PDF and Moments of a Random Variable, Some Useful Distributions, Multiple Random Variables, Sums of Random Variables, Function of a Random Variables. Random Processes: Basic Concepts-Introduction to Stochastic Processes, Statistical Averages, Autocorrelation and Cross-correlation, Orthogonality and Statistical Independence, Stationary and Ergodic Process, Wide – Sense Stationary Processes, Response of Linear System to Random Processes, Power Spectral Density of Stationary Processes and Sum Process, Statistical Properties of Additive White Gaussian Noise

Unit 3

Quantization and Pulse Coding: Quantization and Pre-processing, Pulse Code Modulation (PCM), Logarithmic Pulse Code Modulation (Log PCM) and Companding, Differential Pulse Code Modulation (DPCM), Delta Modulation and Adaptive Delta Modulation

Unit 4

Digital Carrier Modulation AND Optimum Reception of Digital Signal through AWGN Baseband Channel, Introduction to Carrier Modulation, ASK, BPSK, QPSK, BFSK, M-ary PSK, M-ary FSK, Modulations, QAM, MSK and GMSK Modulation, Differential Encoding and Decoding, Binary Pulse Shaping and Optimum Threshold Detection, Optimum Receiver for Binary Pulse Shaped Signals in AWGN Channel-Correlation Receiver Structure; Matched Filter, Equivalence between Correlation

Decoder and Matched Filter; Eye Diagram. The Performance of the Optimum Detector for Binary Signals; Derivation of Probability of Error for ASK, BPSK, QPSK and M-Ary PSK. Geometric Representation of Waveforms in Signal Space; Optimum M-Ary receiver; Maximum A-posteriori Detection and Maximum Likelihood Detection, Digital Transmission through Band-limited AWGN Channel-Nyquist Filtering and Inter Symbol Interference, Pulse Shape Design for Channels with ISI; Equalization.

Unit 5

Elements of Information Theory and Coding: Information, Mutual Information, Measure of Information, Entropy, Information Rate, Shannon's Theorem, Channel Capacity, Capacity of Gaussian Channel, Bandwidth-SNR Trade-off; Coding for Discrete Sources- Need for coding source letters, Variable length coding, Prefix – condition code, Huffman Coding; Introduction to channel coding; Error Control coding; Spread spectrum Communication and Multicarrier Communication

Textbooks:

1. S. Haykin, "Communication Systems", 5th ed., John wiley, 2008.
2. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems 4th ed., Oxford University Press, 2009
3. H. Taub and D. L. Schilling, "Principles of communication systems", 2n ed., McGraw-Hill, 1986

Reference Book:

1. J. Proakis and M. Salehi, "Digital Communications", 5th ed., McGraw-Hill Higher Education, 2013.
2. B. Skalar, "Digital Communications: Fundamentals & Applications", 2nd ed., Pearson Education India, 2009.

Electronic Measurements and Instrumentation

Unit 1

Theory of Errors: Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors Modelling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors

Unit 2

Electronic Instruments for Measuring Basic Parameters: Electronic Voltmeter, Electronic Multi-meters, Digital Voltmeter, Component Measuring Instruments, Q meter, Vector Impedance meter, RF Power & Voltage Measurements, Measurement of frequency. Introduction to shielding & grounding

Unit 3

Oscilloscopes: CRT Construction, Basic CRO circuits, CRO Probes, Oscilloscope Techniques of Measurement of frequency, Phase Angle and Time Delay, Multi-beam, multi trace, Storage & sampling, Oscilloscopes, Curve tracers.

Unit 4

Signal Generation: Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators. Signal Analysis – Measurement Technique, Wave Analysers, Frequency-selective wave analyser, heterodyne wave analyser, Harmonic distortion analyser, and Spectrum analyser.

Unit 5:

Transducers - Classification, Selection Criteria, Characteristics, Construction, Working Principles, Application of following Transducers- RTD, Thermocouples, Thermistors, LVDT, RVDT, Strain Gauges, Bourdon Tubes, Bellows. Diaphragms, Seismic Accelerometers, Tacho-generators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.

Textbooks:

1. Electronic Instrumentation, H S Kalsi, TMH
2. Electronic Measurements & Instrumentation, Bernard Oliver, John Cage, TMH
3. Electronic Measurements and Instrumentation, Lal Kishore, Pearson
4. Elements of Electronic Instrumentation and Measurement, Carr, Pearson
5. Electronic Instrument and Measurement, Bell, Oxford
6. Electronic Measurements and Instrumentation, Dally, Wiley
7. Introduction to Measurements and Instrumentation, Arun K. Ghosh, PHI

Microprocessor & Microcontroller

Unit 1

Introduction: CPU, address bus, data bus and control bus. Input/ Output devices, buffers, encoders, latches and memories.

Unit 2

8085 Microprocessor Architecture: Internal data operations and registers, pins and signals, peripheral devices and memory organization, interrupts, CISC and RISC architecture overview.

Unit 3

8085 Microprocessor Instructions: Classification, format and timing. Instruction set, Programming and debugging, 8-bit and 16-bit instructions.

Unit 4

8085 Microprocessor Interfacing: 8259, 8257, 8255, 8253, 8155 chips and their applications. A/D conversion, memory, keyboard and display interface (8279).

Unit 5

Introduction to 8051 Micro-controllers: General features & architecture of 8051, Memory, timers and interrupts. Pin details. Interfacing and applications

Textbooks:

1. 8051 Microcontroller: Hardware, Software and Application., V Udayashankara, M Mallikarjunaswamy, TMH
2. Introduction to Microprocessors, Mathur, TMH
3. Modern Microprocessors, Korneev, Wiley
4. The 8085 Microprocessor: Architecture, Programming and Interfacing, K. Udaya Kumar, Pearson
5. Microprocessor Interfacing And Applications, B.P. Singh, New Age
6. Microprocessor: Architecture, Programming and Application For 8085, Goankar, Penram International
7. Microprocessor: Architecture, Programming And System Featuring In 8085, William A. Routt, Delmur Pub
8. The 8051 Microcontrollers & Embedded Systems, Mazidi, Pearson

Intellectual Property Right

OUTLINE:

The course is designed to introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. The course introduces all aspects of the IPR Acts. It also includes case studies to demonstrate the application of the legal concepts in Science, Engineering, Technology and Creative Design.

Unit 1

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit 2

Trademarks: Purpose and function of trademarks, acquisition of trademark rights, protectable matter, selecting, and evaluating trademark, trade mark registration processes.

Unit 3

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit 4

Trade Secrets: Trade secrete law, determination of trade secretes status, liability for misappropriations of trade secrets, protection for submission and trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

Unit 5

New development of intellectual property: new developments in trademark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trademark law, copy right law, international patent law, and international development in trade secrets law.

Textbooks& References:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

2. Intellectual property right – Unleashing the knowledge economy, Prabuddha Ganguli, Tate McGraw Hill Publishing company ltd.

REFERENCES

1. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd, 2006

2. B.L. Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000

3 P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010

SEMESTER VI

Digital Signal Processing

Unit 1

DSP Preliminaries, Sampling, DT signals, sampling theorem in time domain, sampling of analog signals, recovery of analog signals, and analytical treatment with examples, mapping between analog frequencies to digital frequency, representation of signals as vectors, concept of Basis function and orthogonality. Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing.

Unit 2

Discrete Fourier Transform, DTFT, Definition, Frequency domain sampling , DFT, Properties of DFT, circular convolution, linear convolution, Computation of linear convolution using circular convolution, FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm, Linear filtering using overlap add and overlap save method, Introduction to Discrete Cosine Transform.

Unit 3

Z transform, Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Relation between pole locations and time domain behaviour, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations.

Unit 4

IIR Filter Design, Concept of analog filter design (required for digital filter design), Design of IIR filters from analog filters, IIR filter design by approximation of derivatives, IIR filter design by impulse invariance method, Bilinear transformation method, warping effect. Characteristics of Butterworth filters, Chebyshev filters and elliptic filters, Butterworth filter design, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design

Unit 5

FIR Filter Design, Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. FIR filters realization using direct form, cascade form and lattice form, Finite word length effect in FIR filter design, Multirate DSP, Introduction to DSP Processor Concept of Multirate DSP, Sampling rate conversion by a non-integer factor, Design of two stage sampling rate converter, General Architecture of DSP, Introduction to Code composer studio, Application of DSP to Voice Processing, Music Processing, Image processing and Radar processing

Textbooks:

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing: Principles, algorithms and applications" Fourth edition, Pearson Prentice Hall.
2. S. Salivahanan, C. Gnanpriya, "Digital Signal processing", McGraw Hill

Reference Books:

1. Ifaeachor E.C, Jervis B. W., "Digital Signal processing: Practical approach", Pearson publication

3. Shaila Apte, "Digital Signal Processing" Wiley India Publication, second edition

4. K.A. Navas, R. Jayadevan, "Lab Primer through MATLAB", PHI
5. Li Tan, Jean Jiang, "Digital Signal Processing: Fundamentals and applications" Academic press.

Industrial Electronics & Drives

Unit 1

Semiconductor Power Devices - Basic characteristics & working of Power Diodes, Diac, SCR, Triac, Power Transistor, MOSFETs, IGBT, and GTO

Unit 2

Rectifiers & Inverters: Working principles of single and three phase bridge rectifiers, Voltage and current source inverters.

Unit 3

Power Supplies: Principle of operation of choppers, Step up, Step down and reversible choppers, High frequency electronic ballast, Switch Mode Power Supply: Fly back converter, forward/buck converter, Boost converter and buck-boost converter, Uninterruptible Power Supply.

Unit 4

Motor Control: Introduction to speed control of DC motors using phase-controlled converters and choppers, Basic idea of speed control of three phase induction motors using voltage and frequency control methods

Unit 5

Stepper Motors: Variable reluctance, Permanent magnet and hybrid stepper motors, Induction and dielectric heating control

Textbooks:

1. Power Electronics Principles & Applications, Joseph Vithayathil, TMH
2. Power Electronics, Ravish Singh, TMH
3. Industrial Electronics and Control, Ttti, TMH
4. Power Electronics: Converters Applications., Mohan, Robbins, Wiley
5. Power Electronics, Moorthi, Oxford
6. Power Electronics, R.S. Murthy, Pearson
7. Power Electronics: Circuits, Devices and Applications, Muhammad. H. Rashid, Pearson

RF & Microwave Engineering

Unit 1

Introduction: Introduction to Microwave Engineering, Microwave System, Microwave Frequencies, Millimetre waves, Lumped and Distributed Elements, Applications of Microwave Engineering, Maxwell's Equation.

Unit 2

Microwave Waveguides: General Solutions for TE, TM, TEM waves, Parallel Plate Waveguide, Rectangular Waveguide, and Circular Waveguide, Coaxial line, Strip line, Microstrip line

Unit 3

Microwave Components: Hybrid microwave circuits–Waveguide Tees, Magic Tees, Hybrid rings, Microwave Cavities–Circular cavity and Rectangular Cavity Resonator, Circulators, Isolators, Directional Couplers, Power Dividers

Unit 4

Microwave Devices: Schottky diode, PIN diode, Varactor diodes, IMPATT diode, TRAPATT diode, BARITT diode, Tunnel diode, Gunn diode, MBT, HBT

Unit 5

Microwave Tubes: Klystrons, Multicavity Klystron, Reflex Klystrons, TWTs, Magnetron

TEXTBOOK:

1. Pozar D.M. “Microwave Engineering”, Fourth Edition, John Wiley & Sons Inc., 2012, ISBN: 978-0-470-63155-3.

2. Liao S.Y. “Microwave Devices and Circuits”, Third Edition, Prentice Hall (Pearson Education).

REFERENCE BOOK:

1. K. C. Gupta, R. Garg, and I. J. Bahl, “Microstrip Lines and Slot lines”, Artech House, Dedham, Mass.

Embedded Systems

Unit 1

Requirement of software in embedded system and features analysis: Reliability, cost effectiveness, low power consumption, efficient use of memory, performance requirement, software features, software issues

Unit 2

Software design: Determine the requirements, Design the system architecture, design patterns, detailed design , Select the OS, Choose the processor and peripherals ,Choose the development platform, Code the applications and optimize, Verify the software on the host system, Verify the software on the target system

Unit 3

Software implementation and testing: languages, compilers, runtime environment and operating system for embedded system; testing methodology and test cases.

Unit 4

Introduction of hardware delay: Creating hardware delay using Timer 0 and Timer 1, creating a portable hardware delay, the need for timeout mechanism, creating loops timeouts, testing loop timeouts, switch interface

Unit 5

Introduction to ARM, features, architecture, instruction set features, Concepts of RTOS.

Textbooks:

1. Embedded C – Micheal J. Pont 2nd Ed. Pearson Education 2008.

References Books:

1. PIC micro MCU C-An introduction to programming, The Microchip PIC in CCS-Nigel Gardner.

Soft Skills

Unit 1

Speech Skill • Rules of Accent • Intonation • Group Discussions and Mock Interviews (Interactive Sessions) Formal Communication • Curriculum Vitae • Minutes • Report Writing

Unit 2

Presentation Skills, Negotiation Skills

Unit 3

Non-Verbal Communication and Body Language, Multicultural Communication

Unit 4

Time Management, Decision Making

Unit 5

Emotional Intelligence

Textbooks:

1. Rizvi, M. Asraf, Effective Technical Communication. Tata McGraw- Hill: New Delhi
2. Sethi J, Kamalesh Sadanand and D.V. Jindal. A Practical Course in English Pronunciation.
3. Chaturvedi, P.D. and Mukesh Chaturvedi. Business Communication, Concepts, Cases, and Applications. Pearson Education: Delhi.
4. Mishra Sunita and C. Muralikrishtna. Communication Skills for Engineers. Pearson Education: Delhi

Departmental Elective Courses (Elective-1)

VLSI Technology

Unit 1

Crystal growth, wafer preparation, epitaxy and oxidation: Electronic Grade Silicon, Czochralski crystal growing, Silicon Shaping, processing considerations, Vaporphase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation, Growth Mechanismand kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxide properties, Redistribution of Dopantsat interface, Oxidation of Poly Silicon, Oxidation inducted Defects.

Unit 2

Lithography and relative plasma etching: Optical Lithography, Electron Lithography, X-Ray Lithography, Ion Lithography, Plasma properties, Feature Size control and Anisotropic Etch mechanism, reactive Plasma Etching techniques and Equipment

Unit 3

Deposition, Diffusion, Ion implementation and Metallization: Deposition process, Poly silicon, plasma assisted Deposition, Models of Diffusion in Solids, Fick's one-**dimensional** Diffusion Equations – Atomic Diffusion Mechanism – Measurement techniques – Range theory- Implant equipment. Annealing Shallow junctions – High energy implantation – Physical vapour deposition – Patterning.

Unit 4

Process simulation and VLSI process integration: Ion implantation – Diffusion and oxidation – Epitaxy – Lithography – Etching and Deposition- NMOS IC Technology – CMOS IC Technology – MOS Memory IC technology - Bipolar IC Technology – IC Fabrication.

Unit 5

Analytical, Assembly Techniques and Packaging of VLSI Devices: Analytical Beams – Beam Specimen interactions - Chemical methods – Package types – packaging design considerations – VLSI assembly technology – Package fabrication technology.

Textbooks:

1. S.M. Sze, "VLSI Technology", McGraw Hill Second Edition. 1998.
2. James D Plummer, Michael D. Deal, Peter B. Griffin, "Silicon VLSI Technology: Fundamentals Practice and Modeling", Prentice Hall India.2000.
3. Wai Kai Chen, "VLSI Technology" CRC Press, 2003.

Information Theory and Coding

Unit 1

Introduction, Measure of information, Average information, Uncertainty, Structure in randomness, Concepts of probability theory, Entropy, Units of entropy, Joint probability distribution functions, Conditional probability and Bayes' theorem, Conditional Probability Distributions and Conditional Entropy, Memoryless Information Sources, The Entropy of Markov Sources.

Unit 2

Information Channels, BSC and BEC Channels, Mutual Information, Importance of Mutual Information, Properties of the Mutual Information, Noiseless and Deterministic Channels, Cascaded Channels, Channel Capacity, Maximum Mutual Information, Channel Capacity of a BSC, Channel Capacity of a BEC, Continuous Channels and Gaussian Channels, Information Capacity Theorem.

Unit 3

Source Coding: Introduction, Instantaneous Codes, The Kraft Inequality, McMillan's Theorem, Average Length and Compact Codes, Shannon's Theorem for Zero-Memory Sources, Shannon's Theorem for Markov Sources, Code Efficiency and Channel Capacity, Fano Coding, Huffman Coding, Arithmetic Coding.

Data Compression: Basic Concepts of Data Compression, Run-length Coding, Block-sorting Compression, Statistical Compression.

Unit 4

Fundamentals of Channel Coding: Introduction, Code Rate, Decoding Rules, Hamming Distance, Hamming Distance Decoding Rule for BSCs, Error Detection/Correction Using the Hamming, Shannon's Fundamental Coding Theorem.

Error-Correcting Codes: Linear Codes, Encoding and Decoding, Codes Derived from Hadamard Matrices.

Unit 5

Cyclic Codes: Introduction, Encoding and Decoding of Cyclic Codes, Encoding and Decoding Circuits for Cyclic Codes, The Golay Code, Hamming Codes, Cyclic Redundancy Check Codes, Bose-Chaudhuri-Hocquenghem Codes, Reed-Solomon Codes.

Convolutional Codes: Introduction, Binary Convolutional Codes, Decoding Convolutional Codes, The Viterbi Algorithm, Sequential Decoding, Trellis Modulation, Turbo Codes.

Textbooks:

1. S. Haykin, "Communications Systems", 4th Edition John Wiley and Sons, 2001.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. K. Sam Shanmugam, "Digital and analog communication systems", John Wiley, 1996.

References Books

1. R.B. Ash, "Information Theory", Prentice Hall, 1970.
2. S. Lin and D.J. Costello Jr., "Error Control Coding", Prentice Hall, 1983.
3. R. Bose, "ITC and Cryptography", TMH, II edition, 2007.

Advanced Logic Design

Unit 1

Course Overview: Design concepts, Introduction to logic circuit and Verilog, Implementation technology, CMOS logic gates, Programmable logic devices, Optimized implementations of logic functions, Canonical representations, Karnaugh maps, Factoring, Functional decomposition, NAND/NOR networks, Bubble pushing

Unit 2

Verilog data types and operators: Modules and ports gate level modelling time simulation/ scheduler, Circuit issues, Verilog behavioural models, Number representation and arithmetic circuits, Positional notation, Signed numbers, Arithmetic operations

Unit 3

Verilog specifications of combinational circuits: Combinational logic building blocks, Encoders/decoders, Arithmetic comparison, The basic latch, gated SR and D latch, master-slave and edge-triggered flip flops, shift registers, Design examples, Introduction to finite state machines, Introduction to model Sim.

Unit 4

Synchronous sequential circuits: Design process, State assignment, Hazards, glitches, Asynchronous design, Metastability

Unit 5

Noise margins, Power, Fan-out, Skew finite state machine design examples Verilog representations

Text/ Reference Books:

1. John F. Wakerly, Digital Design, Pearson Education Asia, 3rd Ed.
2. M. M. Mano, Digital Design, Pearson Education Asia, 3rd Ed.
3. C. H. Roth, Jr., Fundamental of Logic Design, Jaico Publishing House.
4. Fletcher, An Engineering Approach to Digital Design, PHI.
5. J. M. Yarbrough, Digital Logic, Thomson Learning.
6. Stephen Brown and ZyonkoVranesic, Fundamentals of Digital Logic with Verilog Design, McGraw-Hill Higher Education, 2003, ISBN 0-07-283878-7.

Image Processing

Unit 1

Elements of visual perception, Digital Image fundamentals, Basic image processing steps, Image Transforms, Image enhancement in spatial and frequency domain, linear gray level transformations,

Unit 2

Histogram equalization and specification, smoothing & sharpening spatial filters, Image degradation models, image restoration, inverse filtering, Wiener filtering.

Unit 3

Image reconstructions from projections, radon transform, projection theorem of computerized tomography Morphological image processing, dilation, erosion

Unit 4

Basic morphological algorithms, thinning algorithms Edge detection, Edge linking & Boundary Detection, watershed segmentation algorithm

Unit 5

Introduction to object recognition, colour image processing, RGB and HSI colour models, grey level to colour transformations

Textbooks:

1. Gonzalez R.C. and Woods R.E., "Digital Image Processing", Pearson, Second
2. Pratt W.K., "Digital Image Processing", Wiley, Third
3. A.K. Jain, "Fundamentals of Digital Image Processing", PHI

Mobile Communication

Unit 1

Fundamentals of Mobile Communication: Introduction to wire1ess communication, Frequency Division Multiple access, Time Division Multiple access, Spread Spectrum Multiple access, Space Division Multiple access, and OFDM, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trunking and grade of service, improving the capacity of cellular systems and related design problems

Unit 2

2G Technologies: GSM Network architecture, signalling protocol architecture, identifiers, channels, introduction frame structure, speech coder RPE-LTP, authentication and security, call procedure, handoff procedure, services and features

GSM evolution in GPRS and EDGE: Architecture and services offered

IS-95 A& B(CDMA-1): Frequency and channel specifications of forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management

Unit 3

3G Technology: IMT-2000/UMTS: Network architecture, air Interface specification, forward and reverse channels in W-CDMA and CDMA 2000, spreading and modulation, Cell search and synchronization, establishing a connection, hand off and power control in 3G system,

3GPP LTE: Introduction and system overview, Frequency bands and spectrum, network structure, and protocol structure, Frame slots and symbols, modulation, coding, multiple antenna techniques

Unit 4

Emerging Technologies for 4G: 4G Introduction and vision, Multi antenna Technologies: MIMO; software defined radio, Adaptive multiple antenna techniques, radio resource management, QOS requirements, Overview of 4G research initiatives and developments

Unit 5

Mobile Radio Propagation: Study of indoor and outdoor propagation models, Small scale fading and multi-path Small-scale multi-path propagation, parameter of multi-path channels, types of small scale fading, Raleigh and Ricean distribution

Textbooks:

1. William, C. Y. Lee, "Mobile Cellular Telecommunications", 2nd Edition, McGraw Hill, 1990.
2. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press, UK, 2005.

References Books:

1. Rappaport. T.S., "Wireless communications", Pearson Education, 2003.
2. Lawrence Harte, "3G Wireless Demystified", McGraw Hill Publications, 2001.

Artificial Intelligence

Unit 1

Introduction to Artificial Intelligence: Artificial Intelligence and related fields, brief history of AI, applications of Artificial Intelligence, Definition and importance of Knowledge, and Learning.

Problem Solving: Problem Definition, Problem as a state space search, Problem formulation, Problem types, Well-defined problems, Constraint satisfaction problem, Game playing, Production systems

Unit 2

Search Techniques: Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison, Informed search techniques-hill climbing, best first search, greedy search, A* search, Adversarial search techniques-minimax procedure, alpha beta procedure

Unit 3

Knowledge Representation, Inference and Reasoning: Formal logic-connectives, truth table, syntax, semantics, tautology, validity, well formed-formula, propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses, rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system, Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

Unit 4

Structured Knowledge Representation: Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Semantic nets, frames, conceptual dependencies and scripts.

Unit 5

Machine Learning: Concepts of learning, learning from examples, explanation-based learning, learning by analogy, learning by simulating evolution, learning by training neural nets, learning by training perception.

Applications of Artificial Intelligence: Expert Systems, Neural Network, Natural Language Processing, Machine Vision

Text / Reference books:

1. E. Rich and Knight, Artificial Intelligence, McGraw Hill.
2. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.
3. P. H. Winston, Artificial Intelligence, Addison Wesley.
4. Stuart Russel and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson
5. Ivan Bratko, PROLOG Programming for Artificial Intelligence, Addison Wesley.

SEMESTER VII

Mobile & Wireless Communications

Unit 1

Introduction to Wireless Communication System: Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL), Wireless Local Area network (WLAN), Bluetooth and Personal Area Networks.

Unit 2

The Cellular Concept-System Design Fundamentals: Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations

Unit 3

Mobile Radio Propagation Model, Small Scale Fading and diversity: Large scale path loss:-Free Space Propagation loss equation, Path-loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and rician distribution, Statistical for models multipath fading channels and diversity techniques in brief

Unit 4

Multiple Access Techniques: Introduction, Comparisons of multiple Access Strategies TDMA, CDMA, FDMA, OFDM, CSMA Protocols

Unit 5

Wireless Systems: GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture
Recent trends: Introduction to Wi-Fi, Wi-MAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Ad-hoc Network and Mobile Portability, Security issues and challenges in a Wireless network

Textbooks:

1. Theodore. S. Rappaport, Wireless Communications-Principles and practice, Prentice Hall Communications Engineering and Emerging Technologies Series, Upper Saddle River, New Jersey 07458, 1996
2. Martyn Mallick, Mobile and Wireless Design Essentials, Wiley Dreamtech India pvt ltd., 2003
3. Geoff Varall, Roger Belcher, 3G Handset & Network Design, Wiley India pvt ltd., 2003

Reference Books:

1. Jochen Schiller, Mobile Communications, Addision Wesley, 2000
2. William C.Y. Lee, Mobile Communication Design Fundamentals, John Wiley, 1993

Principles of Management

Unit 1

Overview of Management: Definition, Management, Role of managers, Evolution of Management thought, Organization and the environmental factors, Trends and Challenges of Management in Global Scenario

Unit 2

Planning: Nature and purpose of planning, Planning process, Types of plans, Objectives, managing by objective (MBO) Strategies, Types of strategies, Policies, Decision Making, Types of decision, Decision Making Process, Rational Decision Making

Unit 3

Organizing: Nature and purpose of organizing, Organization structure, Formal and informal groups, I organization, Line and Staff authority, Departmentation, Span of control, Centralization and Decentralization, Delegation of authority, Staffing, Selection and Recruitment, Orientation, Career Development, Career stages, Training, Performance Appraisal

Unit 4

Directing: Creativity and Innovation - Motivation and Satisfaction, Motivation Theories, Leadership Styles, Leadership theories, Communication, Barriers to effective communication, Organization Culture, Elements and types of culture, Managing cultural diversity.

Unit 5

Controlling: Process of controlling, Types of control, Budgetary and non-budgetary control Q techniques, Managing Productivity, Cost Control, Purchase Control, Maintenance Control, Quality Control, Planning operations.

Textbooks:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

Reference Books:

1. Hellriegel, Slocum & Jackson, 'Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global Perspective' McGraw-Hill, 2005.

Professional Elective Courses (Elective-2&3)

CMOS VLSI Design

Unit 1

CMOS Design Introduction: Flow of circuit design, Fabrication Process Flow: Basic Steps, Layout Design Rules

Unit 2

CMOS Digital Circuits: Inverters, Static logic gates, Transmission gates and Flip-Flops, Dynamic logic Gate. Memory Circuits

Unit 3

CMOS Analog Circuits: MOS Analog models, Current Sources and sinks, References, amplifiers, Differential Amplifiers, Operational Amplifiers.

Unit 4

CMOS Mixed- Signal Circuits:

Unit 5

Data converter: Fundamentals and Converter architectures.

Reference Books:

1. Behzad Razavi, "Fundamentals of Microelectronics", 2nd Edition, March 2014.

2. Behzad Razavi. 2000. “Design of Analog CMOS Integrated Circuits”, (1ed.). McGraw-Hill, Inc., New York, NY, USA.
3. R. J. Baker, H W Li, D. E. Boyce, “CMOS Circuit design, Layout and Simulation”, PHI EEE
4. Neil H. E. Weste, Kamran Eshraghian, Addison Wesley, “Principles of CMOS VLSI Design”
5. Etienne Sicard, “Basics of CMOS Cell Design”
6. John P. Uyemura, “CIRCUIT DESIGN for CMOS VLSI”
7. R. Jacob Baker, “CMOS Circuit Design, Layout, and Simulation”.

Low Power VLSI Design

Unit 1

Low Power Microelectronics: Retrospect and Prospect, Fundamentals of power dissipation in microelectronic devices, Estimation of power dissipation due to switching, short circuit, sub-threshold leakage, and diode leakage currents.

Unit 2

Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation

Unit 3

Simulation Power and Probabilistic Power Analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems. Monte-Carlo simulation, Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Unit 4

Low Voltage Technologies and Circuits: Threshold Voltage Scaling and Control, Multiple Threshold CMOS (MTCMOS), Substrate Bias Controlled Variable Threshold CMOS, Testing Issues: Design and test of low-voltage CMOS circuits.

Unit 5

Algorithm and architectural level Methodologies: Introduction, design flow, algorithmic level analysis and optimization, Architectural level estimation and synthesis.

Textbooks:

1. Roy, K. and Prasad, Sharat C., "Low Power CMOS VLSI: Circuit Design", John Wiley, 2009.
2. Chandrakasan, A.P. and Broderson, R.W., "Low Power Digital CMOS Design", Kluwer, 2000.

Reference Books:

1. Rabaey J.M. and Pedram, M., "Low Power Design Methodologies", Springer, 2012
2. Yeo, K.S. and Roy K., Low Voltage, "Low Power VLSI Subsystems", McGraw Hill 2004

FPGA Design

Unit 1

Introduction to ASICs and FPGAs, Fundamentals in digital IC design, FPGA & CPLD Architectures, FPGA Programming Technologies

Unit 2

FPGA Logic Cell Structures, FPGA Programmable Interconnect and I/O Ports, FPGA Implementation of Combinational Circuits

Unit 3

FPGA Sequential Circuits, Timing Issues in FPGA Synchronous Circuits, Introduction to Verilog HDL and FPGA Design flow with using verilog HDL

Unit 4

FPGA Arithmetic Circuits, FPGAs in DSP Applications, Design Case Study, Design of SDRAM Controller

Unit 5

Design Case Study: Design of Halftone Pixel Converter, Programming FPGAs in Electronic Systems, and Design issues in complex systems containing both FPGA and Microprocessors

Textbook:

1. Steve Kilts, "Advanced FPGA Design," Wiley Inter -Science, ISBN 9780470054376.

Reference Book:

1. P. Chu, "FPGA Prototyping by Verilog Examples," Wiley, 2008
2. P. Chu, "FPGA Prototyping by VHDL Examples," Wiley, 2008

Software for Embedded Systems

Unit 1

Requirement of software in embedded system and features analysis: Reliability, cost effectiveness, low power consumption, efficient use of memory, performance requirement, software features, software issues

Unit 2

Software design: Determine the requirements, Design the system architecture, design patterns, detailed design, Select the OS, Select the OS, and choose the processor and peripherals, choose the development platform, Code the applications and optimize, Verify the software on the host system, Verify the software on the target system

Unit 3

Software implementation and testing: Languages, compilers, runtime environment and operating system for embedded system, testing methodology and test cases

Unit 4

Introduction of hardware delay: Creating hardware delay using Timer 0 and Timer 1, creating a portable hardware delay, the need for timeout mechanism, creating loops timeouts, testing loop timeouts, switch interface

Textbooks:

1. Embedded C – Micheal J. Pont 2nd Ed. Pearson Education 2008.

References Books

2. PIC micro MCU C-An introduction to programming, The Microchip PIC in CCS-Nigel Gardner.

Real Time Operating Systems

Unit 1

Introduction to OS and RTOS: Architecture of OS (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed & real –time O.S.

Unit 2

Process Management of OS/RTOS: Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Real Time Scheduling concepts.

Unit 3

Process Synchronization: Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies.

Unit 4

Memory & I/O Management: Memory Management requirements, Memory partitioning: Fixed, dynamic, partitioning, Buddy System Memory allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit), Fragmentation, Swapping, Segmentation, Paging, Virtual Memory, Demand paging, Page Replacement Policies (FIFO, LRU, Optimal, clock) ,Thrashing, Working Set Model.I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches

Unit 5

RTOS Application Domains: Comparison and study of RTOS: Vx works and µCOS-Case studies: RTOS for Image Processing, Embedded RTOS for voice over IP, RTOS for fault Tolerant Applications, RTOS for Control Systems

Books:

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design," 2/e, Kindle Publishers, 2005.
2. Tanenbaum," Modern Operating Systems," 3/e, Pearson Edition, 2007.
3. Jean J Labrosse," Embedded Systems Building Blocks Complete and Ready-to-use Modules in C," 2/e, 1999.
4. C.M. Krishna and G. Shin, "Real Time Systems," McGraw-Hill International Edition, 1997.

Wireless Sensor Networks

Unit 1

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Unit 2

Mobile Adhoc NETworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks, Issues and challenges in wireless sensor networks

Unit 3

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor network, Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols

Unit 4

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication

Unit 5

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to Tiny OS and nesC

Textbooks:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications

Reference Books

2. Sabrie Soloman, “SENSORS” HANDBOOK by Mc Graw Hill publication.
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications.
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inderscience
5. Philip Levis, And David Gay Tinyos “Programming” by Cambridge University Press.

Soft Computing

Unit 1

Artificial neural network: Introduction, characteristics- learning methods –taxonomy – Evolution of neural networks- basic models - important technologies-applications, Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: Cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets, Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

Unit 2

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN-associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hop-field networks, iterative auto-associative memory network & iterative associative memory network – unsupervised learning networks: Kohonenself organizing feature maps, LVQ – CP networks, ART network.

Unit 3

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

Unit 4

Genetic algorithm and search space-general genetic algorithm–operators-Generational cycle - stopping condition–constraints-classification-genetic programming – multilevel optimization – real life problem- advances in GA

Unit 5

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems-simplified fuzzy ARTMAP-Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing-based hybrid fuzzy controllers.

Textbooks:

1. J.S.R. Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI/ Pearson Education 2004.
2. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

References:

1. S.Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.
3. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
5. Simon Haykin, "Neural Networks Comprehensive Foundation" Second Edition, Pearson Education, 2005.

Broadband Networks

Unit 1

Orbital aspects of satellite communication, Attitude and orbit control system, Telemetry tracking and command system (TTC), Power subsystems, Antennas, Reliability

Unit 2

Satellite link design, System noise temperature, G/T ratio, Down link design, Uplink design, Link for specified (C/N) base-band noise signal

Unit 3

Digital Satellite Links, Frequencies and channel allocations, Modulation techniques, QPSK, QAM, BER analysis, medium access methods for satellite communication.

Unit 4

Multicarrier communication systems: DMT, OFDM, MIMO systems

Unit 5

Space-time coding, Wi-Fi, WiMax, UWB systems

Books

1. Timothy Pratt, Charles Bostian, Jeremy Allnut, "Satellite communication", John Willey and Sons Inc. Second edition
2. W. L. Pritchard, H.G. Suyderhoud, R.A. Nelson, "Satellite Communication Systems Engineering", Pearson Education Second edition
3. Wayne Tomasi, "Advanced Electronic communications", PHI Learning, Fifth edition
4. Frank .R. Dungan, "Electronic Communication Systems", International Thomson Publishing Company Third edition
5. J. Proakis, "Digital Communication", 4e, TMH
6. Simon Haykin, "Communication Systems", 4e, John Wiley

Electronic Design automation Tools

Unit 1

Important Concepts in Verilog: Basics of Verilog Language, Operators, Hierarchy, Procedures and Assignments, Timing Controls and Delay. Tasks and Functions Control Statements, Logic-Gate Modelling, Modelling Delay, Altering Parameters, and other Verilog Features

Unit 2

Synthesis and Simulation using HDLS: Verilog and Logic Synthesis, VHDL and Logic Synthesis, Memory Synthesis, FSM Synthesis, Memory Synthesis, Performance-Driven Synthesis, Simulation-Types Of Simulation, Logic Systems Working Of Logic Simulation, Cell Models, Delay Models State Timing Analysis, Formal Verification, Switch-Level Simulation Transistor-Level Simulation, CAD Tools For Synthesis and Simulation Modelism and Leonardo Spectrum (Exemplar)

Unit 3

Tools for Circuit Design And Simulation Using PSPICE: PSPICE Models For Transistors, A/D & D/A Sample and Hold Circuits Etc, and Digital System Building Blocks, Design and Analysis Of Analog and Digital Circuits Using PSPICE.

Unit 4

An Overview of Mixed Signal VLSI Design: Fundamentals of Analog and Digital Simulation, Mixed Signal Simulator Configurations, Understanding Modelling, Integration to CAE Environments, Analyses of Analog Circuits E.g. A/D, D/A Converters, Up and Down Converters, Companders etc.

Unit 5

Tools for PCB Design and Layout: An Overview of High-Speed PCB Design, Design Entry, Simulation and Layout Tools for PCB. Introduction to Orcad PCB Design Tools

Textbooks:

1. J. Bhaskar, A Verilog Primer, BSP, 2003.
2. J. Bhaskar, A Verilog HDL Synthesis BSP, 2003
3. M.H.RASHID: SPICE FOR Circuits And Electronics Using PSPICE (2/E)(1992) PHI

References:

1. ORCAD: Technical Reference Manual, Orcad, USA.
2. SABER: Technical Reference Manual, Analogy Nic, USA.
3. M.J.S.SMITH: Application-Specific Integrated Circuits (1997). Addison Wesley
4. J. Bhaskar, A VHDL Synthesis Primer, BSP, 2003.

Modern Radar Systems

Unit 1

Radar Fundamentals: Introduction, Radar Block Diagram, Monostatic and Bistatic, Radar Classifications, Range, Range Resolution, Doppler Frequency, Pulse Repetition Frequency and Range Ambiguities, The Radar Equation, Radar Losses, Radar Cross Section

Unit 2

Radar Types: CW Radar Functional Block Diagram and CW Radar Equation, Linear FM (LFM) CW Radar, Pulsed Radar, Range and Doppler Ambiguities, Resolving Range Ambiguity, Resolving Doppler Ambiguity. Moving Target Indicator Radar (MTI), Blind Speed, Delay Line Canceller, Synthetic Aperture Radar (SAR), Pulse Doppler radar

Unit 3

Target Detection and Tracking: Detection in Presence of Noise, Probability of False Alarm, Probability of Detection, Pulse Integration, Detection of Fluctuating Targets, Constant False Alarm Rate, Single Target Tracking – Angle Tracking, Sequential Lobbing, Conical Scan, Amplitude Comparison Mono-pulse, and Multiple Target Tracking – Track While Scan (TWS).

Unit 4

Radar Wave Propagation and Clutters: Radar Wave Propagation, Refraction, Ground Reflection, Diffraction. Atmospheric Attenuation, Clutter Definition, Surface Clutter (Land and Sea), Volume Clutter

Unit 5

Radar Antennas: Directivity, Power Gain, Effective Aperture, Near and Far Fields, Antenna Radiation Pattern, Parabolic Reflector Antennas, Lens Antennas, Horn Antennas, Dipole Antennas, Array Antennas, Antenna Stabilization

Textbook(s):

1. Skolnik M.I., "Introduction to Radar Systems", Second Edition, McGraw-Hill Book Company, 1981, ISBN: 0-07-057909-1.

2. Skolnik M.I., "Radar Handbook", Second Edition, McGraw-Hill Book Company, 1990, ISBN: ISBN: 0-07-057913-X.

Reference Book (S):

1. Pozar D.M. "Microwave Engineering", Fourth Edition, John Wiley & Sons Inc., 2012, ISBN: 978-0-470-63155-3
2. Fundamentals of radar signal processing, M. I. Richards, McGraw-Hill
3. Handbook of radar measurement, Barton, David & Ward, H. R, Artech House
4. Radar Technology, Brookner, Eli, Artech House

SEMESTER VIII

Optical Communications

Unit 1

Overview of Optical fibre **Communications**: Electromagnetic spectrum, Optical Spectral bands, Evolution of fibre optic system, Multiplexing Techniques, Elements of an optical fibre transmission link with the functional description of each block, WDM concepts, transmission widows, advantages of optical fibre link over conventional copper systems, applications of fibre optic transmission systems

Unit 2

Optical fibre**s: Structures, Waveguiding and Fabrication**: Optical laws and definitions, optical fibre modes and configurations, Mode theory, Step Index and Graded Index (GI) fibres, single mode and graded index fibres, Derivation for numerical aperture, V number and modes supported by step index fibre, mode field ,Numerical aperture and modes supported by GI fibres, fibre materials, linearly Polarized modes fibre fabrication techniques, and mechanical properties of fibres, fibre optic cable

Unit 3

Signal Degradation in Optical Fibre**s:** Attenuation, signal distortion in optical waveguides, pulse broadening in graded index fibre, Characteristics of Single Mode Fibres, mode coupling, International Standards for optical transmission fibres.

Optical Sources: Semiconductor Physics background, Light emitting diode (LEDs)- structures, materials, Figure of merits, characteristics & Modulation, Laser Diodes -Modes & threshold conditions, Diode Rate equations, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, Spectral width , temperature effects, and Light source linearity

Unit 4

Power Launching and Coupling: Source to fibre power launching, Lensing schemes, fibre-to-fibre joints, LED coupling to single mode fibres, fibre splicing, Optical fibre connectors.

Photodetectors: Principles of operation, types, characteristics, figure of merits of detectors photodiode materials, photo-detector noise, detector response time, temperature effects on gain, comparison of photodetectors.

Optical Receiver Operation: Receiver operation, Preamplifier types, receiver performance and sensitivity, Eye diagrams, Coherent detection, Specification of receivers.

Unit 5

Transmission Systems: Point –to-point link –system considerations, Link power budget and rise time budget methods for design of optical link, BER calculation.

Optical Amplifiers: Semiconductor optical Amplifier, EDFA, Raman Amplifier, Wideband Optical Amplifiers.

Advances in Optical Fibre **Systems:** Principles of WDM, DWDM, Telecommunications & broadband application, SONET/SDH, MUX, Analog & Digital broadband, optical switching.

Overview of Optical Components: Optical couplers, Tunable sources and Filters, optical MUX/DEMUX, Arrayed waveguide grating, optical add drop multiplexer (OADM), optical circulators, attenuators, optical cross connects, wavelength converter, Mach-Zender Interferometer.

Fibre Optical Measurements: Test Equipment, OTDR, Set ups for Measurement of Attenuation, Dispersion, NA and EYE pattern.

Reference Books:

1. Optical Fibre Communications by Gerd Keiser, 4th Edition (Mc Graw Hill)
2. Optical Fibre Communication by John M. Senior (PHI/Pearson)
3. Fibre optical communication Technology by Djafar Mymbaev & Lowell L, Scheiner. (Pearson)
4. Fibre optic Communication Systems by G. Agrawal (John Wiley and sons)

Professional Elective Courses (Elective-4)

Satellite Communications

Unit 1

Satellite Orbits: Kepler's Laws, Newton's law, Orbital Parameters, Orbital Perturbations, Station keeping, Geo Stationary and Non-geo-stationary Orbits, Look Angle Determination- Limits of visibility, Eclipse-Sub Satellite Point, Sun Transit Outage, Launching Procedures, Launch Vehicles and Propulsion.

Unit 2

Space Segment and Satellite Link Design: Spacecraft Technology, Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation, performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

Unit 3

Earth Segment: Transmission losses, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, Link power budget equation, System noise, Antenna noise, Amplifier noise temperature, Amplifiers in cascade, Noise factor, Noise temperature of absorptive networks, Overall system noise temperature, Carrier to Noise ratio, Uplink, Saturation flux density, The earth station, Downlink, Satellite TWTA output, Effects of rain, Uplink rain, Fade margin, Downlink rain, Fade margin, Test equipment measurements on G/T, C/No, EIRP, Antenna Gain.

Unit 4

Satellite Access: Modulation and Multiplexing: Voice, Data, Video, Analog–Digital Transmission System, Digital video Broadcast, Multiple Access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression, encryption.

Unit 5

Satellite Applications: INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, and Satellite Navigational System. Direct Broadcast satellites (DBS), Direct to home Broadcast (DTH), Digital audio broadcast (DAB), World space services, Business TV(BTV), GRAMSAT, Specialized services, E–mail, Video conferencing, Internet.

Textbook (S):

1. Timothy Pratt, Charles W. Bostian, "Satellite Communications", John Wiley & Sons.
2. Dennis Roddy, "Satellite Communication", McGraw Hill International, 4th Edition, 2006.
3. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.

Reference Book (S):

1. W. L. Pritchard, J. A. Sciulli, "Satellite Communication Systems Engineering", PHI
2. M. O. Kolawole, "Satellite Communication Engineering", Marcel Dekker, Inc. NY.

Network Planning & Management

Unit 1

Network traffic data analysis and forecasting, resource planning, procurement and installation Telecom network operation and maintenance system

Unit 2

Case studies of ISDN, ATM, GSM, CDMA networks, Enterprise need analysis and LAN design, component selection, procurement and installation

Unit 3

Network management issues such as configuration management, fault and maintenance management

Unit 4

Security and access management, Management protocols such as SNMP

Unit 5

Web based management tools such as Netconf, management protocol issues such as scalability, efficiency, effectiveness etc.

Text/References

1. Subramanian ; "Network Management" ; Addison Wesley (Low Price Edition)
2. McCabe J.D., "Network analysis, architecture and design", Elsevier
3. FitzGerald J., Dennis A., "Business Data Communications and networking".

Biomedical Engineering

Unit 1

Electrode theory- Electrode electrolyte interface, half-cell potential, Hydrogen, Calomel, Ag-AgCl electrode, needle and wire electrode, surface electrodes, microelectrode-metal micropipette.

Physiological Transducers: Resistive Transducers-Thermistor, Inductive Transducers - Capacitive Transducers-Photoelectric Transducers-Piezoelectric Transducers, Biochemical Transducers- pH, pCo2 and pO2 electrodes.

Unit 2

Sources of Bioelectric potentials - Resting and Action potential-Propagation of Action potential Electrophysiology of Heart, Nervous System and Muscle Activity, Bio-signals: ECG - EEG, Evoked potential – EMG- ERG- Electrodes and Lead System, Typical waveforms and Signal characteristics, Signal Conditioning circuits: Design of low Noise Medical Amplifier, Isolation Amplifier, Protection Circuits and Electrical Safety.

Unit 3

Measurement of Blood Pressure, Blood Flow, Plethysmography, Cardiac Output, Heart Sounds- Lung Volumes and their measurements- Auto analyser –Blood cell counters, Oxygen saturation of Blood

Unit 4

X-ray machine, Computer Tomography, Angiography, Ultrasonography, Magnetic Resonance Imaging System, Nuclear Imaging Techniques, Thermography, Lasers in Medicine, Endoscopy

Unit 5

Bio telemetry, Elements and Design of Bio telemetry system, Assist and Therapeutic devices: Cardiac Pacemakers, Defibrillators, Artificial Heart Valves, Artificial Heart Lung machine, Artificial Kidney, Orthopaedic Prosthetics, Respiratory therapy equipment, Patient Monitoring System.

Books:

1. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeifer, "Biomedical Instrumentation and Measurements", 2nd Edition, PHI, 2006
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", 2nd edition, 12th reprint, Tata McGraw Hill, 2008
3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4th edition, Pearson Education, 2008
4. John G. Webster, "Medical Instrumentation Application and Design", 3rd edition, Wiley India, 2008

Network Security

Unit 1

Services: Services, mechanisms and attacks, The OSI security architecture, A model for network security.

Unit 2

Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

Unit 3

Principles of Public-Key Cryptosystems: Principles of Public-Key Cryptosystems, The RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, and Authentication functions, Hash Functions.

Digital signatures: Digital signatures, Authentication Protocols, Digital Signature Standard

Unit 4

Web Security Consideration: Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction.

Intruders: Intruders, Intrusion Detection, Password Management

Unit 5

Malicious Software: Viruses and Related Threats, Virus Countermeasures.

Firewalls Design Principles: Firewalls Design Principles, Trusted Systems.

Reference Books:

1. Alfred J Menezes and Scott A Vanstone "Handbook of Applied Cryptography"
2. William Stallings "Cryptography and Network Security: Principles and Practice"
3. Neal Koblitz "A Course in Number Theory and Cryptography"
4. Johannes A Buchmann "Introduction to Cryptography"

Applied Photonics

Unit 1

Review of basic optics, Polarization, Reflection and refraction of plane waves

Unit 2

Diffraction: diffraction by single slit and circular aperture, Gaussian beams,
Fibre Optics; Fourier optics

Unit 3

Interference: two-beam and multiple beam interference, Fabry-Perot interferometer

Unit 4

Interaction of radiation with matter, light amplification; Laser rate equations, three level and four level systems; Optical Resonators, resonator stability

Unit 5

Mode selection; Q switching and mode locking in lasers: Properties of laser radiation and some laser systems

Textbooks/Reference Books:

1. Saleh B. E. A. and Teich M.C., *Fundamentals of Photonics*, Wiley-Interscience.
2. Hecht E., *Optics*, Addison-Wesley.
3. Yariv A., *Photonics*, Oxford University Press, USA.
4. Ghatak A. and Thayagrajan K., *Optical Electronics*, Cambridge University Press.
5. Ghatak A. and Thayagrajan K., *An Introduction to Fibre Optics*, Cambridge University Press.
6. Feynmann R., *Lectures on Physics*, Basic Books.

Adaptive Signal Processing

Unit 1

Vectors, Matrices and Eigen Analysis, Application to adaptive signal processing

Unit 2

Stochastic Processes, Ensemble average, mean, average power, auto and cross correlation functions, stationarity and white noise, Auto-regressive process

Unit 3

Least Squares and LMS algorithms, Normal equations, properties, Eigen System decomposition, Gradient search technique, convergence properties of LMS

Unit 4

Normalized LMS algorithm, Recursive solution techniques, RLS algorithm

Unit 5

Application to noise cancellation, modelling of physical processes, communications

Textbooks:

1. S. Haykin, "Adaptive Filter Theory", Fourth Edition Prentice Hall
2. B. Widrow and S. D. Sterns, "Adaptive Signal Processing", Pearson Education
3. M. J. Larrimore, C. R. Johnson and J. R. "Theory and Design of Adaptive Filters", publisher

Statistical Signal Processing

Unit 1

Review of random variables Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Schwarz Inequality Orthogonality principle in estimation, Central Limit theorem, Random processes, wide-sense stationary processes, autocorrelation and auto-covariance functions, Spectral representation of random signals, Wiener Khinchin theorem Properties of power spectral density, Gaussian Process and White noise process. Random signal modelling: MA (q), AR (p) , ARMA (p,q) models.

Unit 2

Parameter Estimation Theory Principle of estimation and applications, Properties of estimates, unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE), Cramer Rao bound, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties; Baysean estimation : Mean square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation.

Unit 3

Estimation of signal in presence of white Gaussian Noise Linear Minimum Mean-Square Error (LMMSE) Filtering: Wiener Hoff Equation, FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear Prediction of Signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.

Unit 4

Adaptive Filtering: Principle and Application, Steepest Descent Algorithm Convergence characteristics; LMS algorithm, convergence, excess mean square error, Leaky LMS algorithm; Application of Adaptive filters; RLS algorithm, derivation, Matrix inversion Lemma, Initialization, tracking of non-stationarity.

Kalman filtering: State-space model and the optimal state estimation problem, discrete Kalman filter, continuous-time Kalman filter, extended Kalman filter.

Unit 5

Spectral analysis: Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Blackman and Tukey method of smoothing periodogram, Prometric method, AR (p) spectral estimation and detection of Harmonic signals, MUSIC algorithm.

Textbook:

1. Discrete Random Signals and Statistical Signal Processing, By Charles W. Therrien, Prentice Hall Signal Processing Series

Reference Books:

2. M. H. Hayes, Statistical Digital Signal Processing and Modelling, John Wiley & Sons, Inc.,
3. D.G. Manolakis, V.K. Ingle and S.M. Kogon: Statistical and Adaptive Signal Processing, McGraw Hill, 2000.
4. Monson H. Hayes, 'Statistical Digital Signal Processing and Modelling", John Wiley and Sons, Inc, Singapore, 2002.
5. J. G. Proakis et. al., Algorithms for Statistical Signal Processing, Pearson Education, 2002.
6. Simon Haykin: Adaptive Filter Theory, Prentice Hall, 1996.

Open Elective

Entrepreneurship

OUTLINE

- The course is designed to develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.
- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

Unit 1

Entrepreneurship: Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

Unit 2

Motivation: Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

Unit 3

Business: Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business

opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

Unit 4

Financing and Accounting: Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

Unit 5

Support to Entrepreneurs: Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Subcontracting.

Textbooks:

- S.S. Khanka, "Entrepreneurial Development" S. Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
- Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9th edition, Cengage Learning 2014.

References:

- Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
- Mathew J Manimala, "Entrepreneurship Theory at Crossroads: paradigms and Praxis", 2nd Edition Dream Tech, 2005.
- Rajeev Roy, "Entrepreneurship" 2nd edition, Oxford University Press, 2011.
- EDII "Faulty and External Experts – A Handbook for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad.