ELECTRONICS & COMMUINCATION ENGINEERING

Paper -I	Paper-II
• Electromagnetic field theory and microwave antennas---10EC101	• EMI / EMC----10EC201
• Microwave antennas---10EC102	• RF circuit design----10EC202
• Wireless communications and Networks----10EC103	• Digital data communications----10EC203
• Optical communications & Networks----10EC104	• Coding theory and practice----10EC204
• Detection and estimation of signals----10EC105	• Advanced computer architecture----10EC205
• Internet protocols----10EC106	• Microcomputer system design----10EC206
• Advanced operating systems----10EC107	• Neural networks and Applications----10EC207
• Network security and cryptography----10EC108	• Neural networks and fuzzy systems----10EC208
• VLSI Technology and Design----10EC109	• Algorithms for VLSI Design Automation----10EC209
• Low power VLSI Design-------10EC110	• Digital System Design----10EC210
• CPLD and FPGA architecture and applications----10EC111	• Analog and Digital IC Design----10EC211
• Speech Processing----10EC112	• Embedded system Design----10EC212
• Transform techniques----10EC113	• Embedded and real time systems----10EC213
• Radar Signal processing----10EC114	• Image and Video processing----10EC214
• Statistical signal processing----10EC115	• Advanced Digital signal processing----10EC215
• Process Control & Instrumentation----10EC116	• Digital Control Systems----10EC216

ELECTROMAGNETIC FIELD THEORY & MICROWAVE ANTENNAS

Unit – I :

Review of Basic Concepts, Maxwell's equations, Wave equation, Plane waves in lossless and lossy media, Reflection and Refraction.

Unit – II:

Plane wave functions, General Solution of waveguide, Rectangular wave guide, Partially filled wave guide, Dielectric slab guide, Surface wave Transmission lines.

Unit – III :

Antenna Parameters, Theories of radiation, Schelkunoff's equivalence theorem, Image theory, Integral transform method.

Unit – IV :

Aperture antennas, Slots, Horns, Lenses and reflector antennas, Log – periodic and Helical Antennas.

Unit – V :

Linear arrays, Uniform and Nonuniform amplitude distortion, Binominal Chebyshev and Taylor's distributions.

Unit – VI :

Printed antennas: Rectangular and circular patch antenna design, Feeding techniques for microstrip antennas, Printed antenna arrays, bandwidth enhancement techniques.

References:

1. Harington, RF.. Time Hormonic Electromagnetic Fields, Mc Graw Hill, 1961.
2. Collin, RE.. Field Theory of guided waves. Mc Graw Hill, 1960.
3. Samuel Silver, Microwave Antenna Theory and Design, IEE press, 1984.
4. James JR. Hall. PS. Wood, C. Microstrip Antenna – Theory and Design, Peter Peregrinu 1981.
5. Bahl. I.J. And Bhartia, Microstrip Antennas, Artech House, 1982.

MICROWAVE ANTENNAS

1. **Antenna Parameters :** Radiation Patterns, Radiation Power Density, Radiation Intensity, Gain, Antenna Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Antenna as an Aperture, Directivity and maximum Aperture, Friis Transmission Equation, Antenna Temperature.

2. **Reflector Antennas :** Plane Reflector, Corner Reflector, 90^{o} Corner Reflector, Other Corner Reflectors, Parabolic Reflector, Front – Fed Parabolic Reflector, Cassegrain Reflectros, Lens Antennas, Lenses with $n>1$, Lenses with $n<1$, Lenses with variable Index of Refraction.

3. **Antenna Arrays :** Introduction, Two Element Array, N-Element Linear Array – Uniform amplitude and Spacing, Broadside Array, Ordinary End – Fire Array, Phased Array, Hansen – Woodyard End – Fire Array, N-Element Linear Array- Directivity, Nonuniform Amplitude, Binomial Array – Design equations.

4. **Microstrip Radiators :** Definition of microstrip antenna, advantages and disadvantages of microstrip antennas, applications, Radiation mechanism and Radiation fields of microstrip antennas, excitation techniques.

5. **Rectangular microstrip patch antennas :** Introduction, Analysis of Rectangular patch radiators, The vector potential approach, Dyadic Green's Function Techniques the cavity model, Model Expansion Model, the transmission line model, Bandwidth Enhancement Techniques.

Suggested reading:

1. J.D. Kraus, Antennas, MC Graw – Hill, ISE, 1988.
2. Constantine A. Balanis, "Antenna theory analysis and Design", John Wiley.
3. J.J. Bahl and Bhartia, "Microstrip antennas", Artech House, 1982.

References:

1. Samuel Silver, "Microwave Antenna – Theory and Design", IEE Press, London 1984.
2. James J. Hall, P.S. Wood, Microstrip Antenna – Theory and Design, 1981.

WIRELESS COMMUNCIATIONS AND NETWORKS

UNIT I

WIRELESS COMMUNICATIONS & SYSTEM FUNDAMENTALS: Introduction to wireless communications systems, examples, comparisons & trends. Cellular concepts-frequency reuse, strategies, interference & system capacity, trucking & grade of service, improving coverage &capacity in cellular systems.

UNIT II

MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION: FDMA, TDMA, SSMA (FHMA/CDMA/Hybrid techniques),SDMA technique(AS applicable to wireless communications).Packet radio access-protocols, CSMA protocols ,reservation protocols ,capture effect in packet radio , capacity of cellular systems .

UNIT III

WIRELESS NETWORKING: Introduction, differences in wireless & fixed telephone networks, traffic routing in wireless networks –circuit switching, packet switching X.25 protocol.

UNIT IV

Wireless data services – cellular digital packet data (CDPD), advanced radio data information systems, RAM mobile data (RMD). Common channel signaling (CCS), ISDN-Broad band ISDN & ATM ,Signaling System no .7(SS7)-protocols, network services part, user part, signaling traffic, services & performance.

UNIT V

MOBILE IP AND WIRELESS APPLICATION PROTOCOL: Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling, WAP Architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, Wireless datagram protocol.

UNIT VI

WIRELESS LAN TECHNOLOGY: Infrared LANs, Spread spectrum LANs, Narrow bank microwave LANs, IEEE 802 protocol Architecture, IEEE802 architecture and services, 802.11 medium access control, 802.11 physical layer.

UNIT VII

BLUE TOOTH : Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

UNIT VIII

MOBILE DATA NETWORKS: Introduction, Data oriented CDPD Network, GPRS and higher data rates, Short messaging service in GSM, Mobile application protocol.

TEXTBOOKS

1. Wireless Communication and Networking – William Stallings, PHI, 2003.
2. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, PHI, 2nd Edn., 2002.
3. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy,Pearson Education, 2002.

REFERENCES

1. Wireless Digital Communications – Kamilo Feher, PHI, 1999.

Optical Communication and Networks

Unit –I

Overview of optical fiber communications: The evolution of fiber optic systems, elements of an optical fiber transmission link. Advantages of optical fiber communication, applications.

Unit – II

Optical Fibers: structures, wave guiding, Nature of light, Basic optical laws and definitions, optical fiber modes and configurations (Fiber types, Rays and modes, step index and graded index fibers). mode theory of circular waveguides.

Unit – III

Optical sources: LEDs, structures, quantum efficiency, modulation capability, Laser diodes: Laser diodes and threshold conditions, external quantum efficiency resonant frequencies, laser diode structures and radiation pattern, temperature effects, reliability.

Unit – IV

Photo Detectors: Physical principles of photodiodes (pin Photodiode, avalanche, photo diode) comparison of photo detectors, noise in detectors.

Unit – V

Fabrication, cabling and installation: Fabrication, fiber optic cables, Installation- placing the cable.

Unit – VI

Optical Communication Systems: Block diagrams of optical communication systems, direct intensity modulation, digital communication systems, Laser semiconductor transmitter, Generations of optical fiber link, description of 8 Mb/s optical fiber communication link, description of 2.5 Gb/s optical fiber communication link.

Unit – VII

Components of fiber optic Networks: Overview of fiber optic networks, Transreceiver, semiconductors optical amplifiers, couplers/splicers, wavelength division multiplexers and de-multiplexers, filters, isolators and optical switches.

Unit – VIII

Fiber Optic Networks: Basic networks, SONET/SDIT, Broad cast and select WDM Networks, wavelength routed networks, optical CDMA.

Text Books:

1.Optical fiber communications – Gerd Keiser, 3 rd Ed. MGH.

2.Fiber Optic Communication Technology – Djafar K. Mynbaev and Lowell L. Scheiner, (Pearson Education Asia)

3.Optoelectronic devices and systems – S.C.

Gupta, PHI, 2005. Reference:

1.Fiber Optics Communications – Harold Kolimbiris (Pearson Education Asia)

2.Optical Fiber Communications and its applications – S.C. Gupta (PHI) 2004.

3.WDM Optical Networks – C. Siva Ram Murthy and Mohan Guru Swamy, PHI.

4. Fiber Optic communications – D.C. Agarwal, S.Chand Publications, 2004.

DETECTION AND ESTIMATION OF SIGNALS

UNIT I

Introduction to Discrete-time signals:- Fourier Transform of a discrete time signal. Amplitude and phase spectrum. Frequency content and sampling rates. Transfer function. Frequency response.

UNIT II

Random – Discrete-time signals:- Review of probability – Random data – Generation of Pseudo-random noise – Filtered signals – Autocorrelation and power spectral density – Sampling band – Limited random signals.

UNIT III

Detection of signals in noise:- Minimum probability of Error Criterion – Neyman – Person criterion for Radar detection of constant and variable – amplitude signals – Matched filters. Optimum formulation – Detection of Random signals – Simple problems thereon with multisample cases.

UNIT IV

Estimation of signals in noise:- Linear mean squared estimation – Non linear estimates – MLP and ML estimates – Maximum likelihood estimate of parameters of linear system. Simple problems thereon.

UNIT V

Recursive linear mean squared estimation:- Estimation of a signal parameter. Estimation of time-varying signals – Kalman filtering – Filtering signals in noise – Treatment restricted to two variable case only – Simple problems.

TEXT BOOKS

1. Signal processing: Discrete Spectral analysis, Detection and Estimation, Mischa Schwartz and Leonard Shaw, Mc-Graw Hill Book Company, 1975.

REFERENCES

1. E.L. Van Trees, Detection, Estimation and Modulation Theory, Wiley New York, 1968.
2. Shanmugam and Breipohl, 'Detection of signals in noise and estimation', John Wiley & Sons, New York, 1985.
3. Srinath, Rajasekaran & Viswanathan, Introduction to statistical Signal processing with Applications, Prentice Hall of India, New Delhi, 110 001,1989.

Internet Protocols

Unit – 1

Introduction: Internet administration and standards. The OSI model and TCP/IP protocol, TCP/IP Versions.

Unit – 2

Internet Protocol – Part 1: IP addressing, different classes, subnetting, supernetting.

Unit – 3

Delivery and routing of IP packets, IP design, ARP and RARP.

Unit – 4

Internet Protocol – Part III: Internet control message protocol, message format, error reporting and query, ICMP design, Internet group message protocol and its design, user datagram protocol, operation and design.

Unit – 5

Transmission Control Protocol: TCP services, flow control, error control, connection, congestion control, TCP design and operation, routing protocols, RIP, OSPF and BGP.

Unit – 6

BOOTP and DHCP, DNS name space, distribution of name space, DNS resolution, types of records, Telnet and remote login.

Unit – 7

File Transfer Protocol, connection, communication and command processing, TFTP, simple mail transfer protocol, addresses, mail delivery, multipurpose Internet mail extensions. Post office protocol.

Unit – 8

Simple Network Management Protocol, Hypertext Transfer Protocol, Next Generation IP Protocols, IPv6.

Text Books:

1.TCP/IP Protocol Suite – By Behrouz A. Porouzan, TMH, ed.-2000.

2. Internet Working with TCP/IP Vol.I: Principles, Protocols and Architecture – by Douglas E. Comes. (PHI) - 1997.

ADVANCED OPERATING SYSTEMS

UNIT I

Introduction to Operating Systems, Type of operating systems.

UNIT II

UNIX –I Overview of UNIX system, Structure, file systems, type of file, ordinary & Special
files, file permissions, Introduction to shell.

UNIT III

UNIX – II, UNIX basic commands & command arguments, Standard input / output Input / output redirection, filters and editors.

UNIT IV

UNIX SYSTEMS CALLS
System calls related file structures, input / output process creation & termination.

UNIT V

INTERPROCESS COMMUNICATION IN UNIX :
Introduction, file and record locking, Client – Server example, pipes, FIFOs, Streams & Messages, Name Speces, Systems V IPC,Message queues,Semaphores, Shared Memory, Sockets & TLI.

UNIT VI

INTRODUCTION TO NETWORKS AND NETWORK PROGRAMMING IN UNIX :
Network Primer, TCP/IP – Internet Protocols, Socket Programming – Introduction & overview, UNIX domain protocols, Socket Addresses, Elementary Socket system calls, Simple examples.

UNIT VII

LINUX Introduction to LINUX System, editors and utilities, type of shells.

UNIT VIII

LINUX OPERATIONS Shell operations, file structure, file management, Operations.

TEXT BOOKS

1. The design of the UNIX Operating Systems – Maurice J.Bach (PHI)
2. The UNIX Programming Environment (PHI) – Kernighan & Pike.
3. UNIX Network Programming - W.Richard Stevens (PHI) – 1998.
4. The Complete reference LINUX – Richard Peterson (TMH)
5. UNIX User Guide – Ritchie & Yate

NETWORK SECURITY AND CRYPTOGRAPHY

UNIT I

INTRODUCTION: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. CLASSICAL TECHNIQUES: Conventional Encryption model, Steganography, Classical Encryption Techniques.

UNIT II

MODERN TECHNIQUES: Symplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. ALGORITHMS: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers.

UNIT II

CONVENTIONAL ENCRYPTION: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.
PUBLIC KEY CRYPTOGRAPHY: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptograpy.

UNIT IV

NUMBER THEORY: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms. MESSAGE UTHENTICATION AND HASH FUNCTIONS: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

UNIT V

HASH AND MAC ALGORITHMS: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. DIGITAL SIGNATURES AND AUTHENTICATION PROTOCOLS: Digital signatures, Authentication Protocols, Digital signature standards.

UNIT VI

AUTHENTICATION APPLICATIONS: Kerberos, X.509 directory Authentication service.
ELECTRONIC MAIL SECURITY: Pretty Good Privacy, S/MIME.

UNIT VII

IP SECURITY: Overview, Architecture, Authentication, Encapsulating Security Payload,
Combining security Associations, Key Management. WEB SECURITY: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

UNIT VIII

INTRUDERS, VIRUSES AND WORMS: Intruders, Viruses and Related threats.
FIRE WALLS: Fire wall Design Principles, Trusted systems.

TEXT BOOKS

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education., 2000.

VLSI TECHNOLOGY & DESIGN

UNIT – I
REVIEW OF MICROELECTRONICS AND INTRODUCTION TO MOS TECHNOLOGIES:
(MOS, CMOS, Bi CMOS) Technology trends and projections.

UNIT – II
BASIC ELECTRICAL PROPERTIES OF MOS, CMOS & BICOMS CIRCUITS: Ids-Vds relationships, Threshold voltage Vt, Gm, Gds and Wo, Pass Transistor, MOS,CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model,Latch-up in CMOS circuits.

UNIT – III
LAYOUT DESIGN AND TOOLS: Transistor structures, Wires and Vias , Scalable Design rules , Layout Design tools.

UNIT – IV
LOGIC GATES & LAYOUTS: Static complementary gates, switch logic, Alternative gate circuits, low power gates, Resistive and Inductive interconnect delays.

UNIT – V
COMBINATIONAL LOGIC NETWORKS: Layouts, Simulation, Network delay,interconnect design, power optimization, Switch logic networks, Gate and Networktesting.

UNIT – VI
SEQUENTIAL SYSTEMS: Memory cells and Arrays, clocking disciplines, Design ,power optimization, Design validation and testing.

UNIT – VII
FLOOR PLANNING & ARCHITECTURE DESIGN: Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.

UNIT – VIII
INTRODUCTION TO CAD SYSTEMS (ALGORITHMS) AND CHIP DESIGN: Layout Synthesis and Analysis, Scheduling and printing; Hardware/Software Co-design, chip design methodologies- A simpleDesign example-

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems, K. Eshraghian et . al(3 authors) PHI of India Ltd.,2005
2. Modern VLSI Design, 3rd Edition, Wayne Wolf ,Pearson Education, fifth Indian Reprint, 2005.

REFERENCES:

1. Principals of CMOS Design – N.H.E Weste, K.Eshraghian, Adison Wesley, 2nd Edition.
2. Introduction to VLSI Design – Fabricius, MGH International Edition, 1990.
3. CMOS Circuit Design, Layout and Simulation – Baker, Li Boyce, PHI, 2004. 3

LOW POWER VLSI DESIGN

UNIT I

LOW POWER DESIGN, AN OVER VIEW: Introduction to low- voltage low power design, limitations, Silicon-on-Insulator.

UNIT II

MOS/BiCMOS PROCESSES : Bi CMOS processes, Integration and Isolation considerations, Integrated Analog/Digital CMOS Process.

UNIT III

LOW-VOLTAGE/LOW POWER CMOS/ BICMOS PROCESSES: Deep submicron processes, SOI CMOS, lateral BJT on SOI, future trends and directions of CMOS/BiCMOS processes.

UNIT IV

DEVICE BEHAVIOR AND MODELING: Advanced MOSFET models, limitations of MOSFET models, Bipolar models.

UNIT V

Analytical and Experimental characterization of sub-half micron MOS devices, MOSFET in a Hybrid- mode environment.

UNIT VI

CMOS AND Bi-CMOS LOGIC GATES: Conventional CMOS and BiCMOS logic gates. Performance evaluation

UNIT VII

LOW- VOLTAGE LOW POWER LOGIC CIRCUITS: Comparison of advanced BiCMOS Digital circuits. ESD-free Bi CMOS , Digital circuit operation and comparative Evaluation.

UNIT VIII

LOW POWER LATCHES AND FLIP FLOPS: Evolution of Latches and Flip flops-quality measures for latches and Flip flops, Design perspective.

TEXT BOOKS

1. CMOS/BiCMOS ULSI low voltage, low power by Yeo Rofail/ Gohl(3 Authors)-Pearson Education Asia 1st Indian reprint,2002

REFERENCES

1. Digital Integrated circuits , J.Rabaey PH. N.J 1996
2. CMOS Digital ICs sung-moKang and yusuf leblebici 3rd edition TMH2003(chapter 11)
3. VLSI DSP systems , Parhi, John Wiley & sons, 2003 (chapter 17)
4. IEEE Trans Electron Devices, IEEE J.Solid State Circuits, and other National and International Conferences and Symposia.

CPLD AND FPGA ARCHITECTURE AND APPLICATIONS

UNIT –I

Programmable logic Devices: ROM, PLA, PAL, CPLD, FPGA – Features, Architectures, Programming, Applications and Implementation of MSI circuits using Programmable logic Devices.

UNIT-II

CPLDs: Complex Programmable Logic Devices: Altera series – Max 5000/7000 series and Altera FLEX logic-10000 series CPLD, AMD's- CPLD (Mach 1 to 5), Cypress FLASH 370 Device technology, Lattice pLSI's architectures – 3000 series – Speed performance and in system programmability.

UNIT – III

FPGAs: Field Programmable Gate Arrays- Logic blocks, routing architecture, design flow, technology mapping for FPGAs, Case studies Xilinx XC4000 & ALTERA's FLEX 8000/10000 FPGAs: AT &T ORCA's (Optimized Reconfigurable Cell Array): ACTEL's ACT-1,2,3 and their speed performance

UNIT-IV

Finite State Machines (FSM): Top Down Design, State Transition Table , State assignments for FPGAs, Realization of state machine charts using PAL, Alternative realization for state machine charts using microprogramming, linked state machine, encoded state machine.

UNIT-V

FSM Architectures: Architectures Centered around non registered PLDs, Design of state machines centered around shift registers, One_Hot state machine, Petrinets for state machines-Basic concepts and properties, Finite State Machine-Case study.

UNIT- VI

Design Methods: One –hot design method, Use of ASMs in one-hot design method, Applications of one-hot design method, Extended Petri-nets for parallel controllers, Meta Stability, Synchronization, Complex design using shift registers.

UNIT-VII

System Level Design: Controller, data path designing, Functional partition, Digital front end digital design tools for FPGAs & ASICs, System level design using mentor graphics EDA tool (FPGA Advantage), Design flow using CPLDs and FPGAs.

UNIT - VIII

Case studies: Design considerations using CPLDs and FPGAs of parallel adder cell, parallel adder sequential circuits, counters, multiplexers, parallel controllers.

TEXT BOOKS:

1.Field Programmable Gate Array Technology - S. Trimberger, Edr, 1994, Kluwer Academic Publications.

2.Engineering Digital Design - RICHARD F.TINDER, 2nd Edition, Academic press.

3.Fundamentals of logic design-Charles H. Roth, 4th Edition Jaico Publishing House.

REFERENCES:

1.Digital Design Using Field Programmable Gate Array, P.K.Chan & S. Mourad, 1994, Prentice Hall.

2.Field programmable gate array, S. Brown, R.J.Francis, J.Rose ,Z.G.Vranesic, 2007, BSP.

RADAR SIGNAL PROCESSING

UNIT I

Introduction [1] – Radar Block Diagram, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance [2] – General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, Bistatic Radar.

UNIT II

Detection of Radar Signals in Noise - I [3] : Matched Filter Receiver – Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and Cross-Correlation Receiver. Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise.

UNIT III

Detection of Radar Signals in Noise - II [3] : Detection Criteria – Neyman-Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer. Detectors – Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection - CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in Radar. Radar Signal Management – Schematics, Component Parts, Resources and Constraints.

UNIT IV

Waveform Selection [3, 2] : Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave, Periodic Pulse Train, Single Linear FM Pulse, Noiselike Waveforms. Waveform Design Requirements. Optimum Waveforms for Detection in Clutter, Family of Radar Waveforms.

UNIT V

Pulse Compression in Radar Signals : Introduction, Significance, Types. Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Sidelobes, Stretch Techniques, Generation and Decoding of FM Waveforms – Block Schematic and Characteristics of Passive System, Digital Compression, SAW Pulse Compression.

UNIT VI

Phase Coding Techniques : Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar.

UNIT VII

Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM). Sidelobe Reduction for Phase Coded PC Signals.

UNIT VIII

Other Types of PC Waveforms – Basics of Nonlinear Binary Phase Coded Sequences, Complementary Codes, Huffman Codes, Concatenated Barker Codes. Limiting in Pulse Compression, Cross-Correlation Properties, Compatibility. Comparison of Different Pulse Compresssion Waveforms.

TEXT BOOKS

1) M.I. Skolnik, Radar Handbook, McGraw Hill, 2nd ed., 1991.

2) Fred E. Nathanson, Radar Design Principles – Signal Processing and The Environment, PHI, 2nd ed., 1999.

3) M.I. Skolnik, Introduction to Radar Systems, TMH, 3rd ed., 2001.

REFERENCES

1) Peyton Z. Peebles, Jr., Radar Principles, John Wiley, 2004.

2) R. Nitzberg, Radar Signal Processing and Adaptive Systems, Artech House, 1999.

3) F.E. Nathanson, Radar Design Principles, McGraw Hill, 1st ed., 1969. &

Nelson Morgan, 1/e, Wiley.

SPEECH PROCESSING

UNIT – I

FUNDAMENTALS OF DIGITAL SPEECH PROCESSING: Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production, Digital models for speech signals.

UNIT – II

TIME DOMAIN MODELS FOR SPEECH PROCESSING: Introduction, Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech vs. silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT – III

LINEAR PREDICTIVE CODING (LPC): Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Pitch Detection and using LPC Parameters.

UNIT – IV

HOMOMORPHIC SPEECH PROCESSING: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, Mel frequency cepstrum computation.

UNIT – V

SPEECH ENHANCEMENT: Nature of interfering sounds, Speech enhancement techniques: spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter.

UNIT – VI

AUTOMATIC SPEECH RECOGNITION: Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System.

UNIT – VII

HIDDEN MARKOV MODEL FOR SPEECH RECOGNITION: Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), Language models.

UNIT – VIII

SPEAKER RECOGNITION: Issues in speaker recognition and speech synthesis of different speakers. Text to speech conversion, , Calculating acoustic parameters,

synthesized speech output performance and characteristics of text to speech, Voice processing hardware and software architectures.

TEXT BOOKS:

1. Digital processing of speech signals - L.R Rabiner and S.W. Schafer. Pearson Education.
2. Speech Communications: Human & Machine - Douglas O'Shaughnessy, 2nd ed., IEEE Press.
3. Fundamentals of Speech Recognition. L.R Rabinar and B.H. Juang.

REFERENCES:

1. Discrete Time Speech Signal Processing: Principles and Practice - Thomas F. Quateri 1st ed., PE.
2. Speech & Audio Signal Processing- Ben Gold & Nelson Morgan, 1 ed., Wiley.
3. Speech Recognition - Claudio Becchetti and Lucio Prina Ricotti, Wiley

Transform Techniques

1. Review of Transforms

Introduction, Need for transform, Image transform, Fourier Transform, 2D Discrete Fourier Transform, Properties of 2D- DFT, Importance of Phase, Walsh transform, Hadamard Transform, Haar Transform, Slant Transform, Discrete Cosine Transform, Karhunen-Loeve Transform, Singular value Decomposition, Radon Transform, and Comparison of Different Image transforms.

2. Fourier Analysis

Fourier series, Examples, Fourier Transform, Properties of Fourier Transform, Examples of Fourier transform, sampling theorem, Partial sum and Gibbs phenomenon, Fourier analysis of Discrete time Signals, Discrete Fourier Transform

Time – Frequency Analysis: Window function, Short Time Fourier Transform, Discrete Short Time Fourier Transform, Discrete Gabor Representation, Continuous wavelet transform, Discrete wavelet transform, wavelet series, Interpretations of the Time-Frequency plot, Wigner-Ville Distribution, Quadratic Superposition principle, Ambiguity function

3. Multiresolution Analysis

Multiresolution analysis, Orthogonal, Biorthogonal and semiorthogonal decomposition, Two scale relations, Decomposition relation, Spline functions, Mapping a function into MRA space

4. Construction of wavelets

Necessary ingredients for wavelet construction, construction of semiorthogonal spline wavelets, Construction of orthonormal wavelets, Orthonormal scaling functions, Construction of Bioorthogonal wavelets

5. Discrete wavelet transform and filter bank algorithms

Decimation and Interpolation, Signal representation in the approximation subspace, wavelet decomposition algorithm, reconstruction algorithm, change of bases, Signal reconstruction in semiorthogonal subspaces, Two channel perfect reconstruction filter bank, Polyphase representation of filter banks, comments on DWT and PR filter banks

6. Digital Signal processing Applications

Wavelet packets, Wavelet packet algorithms, Thresholding-Hard thresholding, Soft thresholding, Percentage thresholding, Implementation, Interference suppression, Faulty bearing signature identification- Pattern Recognition of Acoustic Signals, Wavelets, Wavelet packets, and FFT features

Two Dimensional wavelets and wavelet packets, Wavelet and Wavelet packet algorithms for two dimensional signals, Image compression, Microcalcification cluster Detection

7. Lifting scheme

Wavelet transform using polyphase matrix factorization, Geometrical foundations of lifting scheme, lifting scheme in the Z-domain, Mathmatical preliminaries for polyphase factorization

8. Beyond wavelets: The Ridgelets and curvelets

Why ridgelets and curvelets?, The ridgelet transform, The digital curvelet transform second generation curvelets

Text Books

1. S. Jayaraman, S. Esakkirajan and T. Veerakumar, "Digital image processing" Mc Graw Hill publishers, 2009 ISBN (13) 978-0-07-014479-8 (1st chapter)
2. Jaideva C.Goswami and Andrew K.Chan, " Fundamentals of Wavelets" Wiley publishers, 2006 ISBN 81-265-1032-3 (Chapters 2 to 6)
3. K.P.Soman and K.I Ramachandran, " Insight into Wavelets – from theory to practice" PHI, Second edition,2008 ((ISBN 978-81-203-2902-7) (Chapter 7 & 8)

Reference Book

1. P.P.Vaidyanathan, "Multirate systems and Filter Banks" Pearson education, 2008, ISBN 978-81-7758-942-9

STATISTICAL SIGNAL PROCESSING

UNIT I

SIGNAL MODELS AND CHARACTERIZATION: Types and properties of statistical models for signals and how they relate to signal processing,Common second-order methods of characterizing signals including autocorrelation,partial correlation, cross-correlation, power spectral density and cross-power spectral density.

UNIT II

SPECTRAL ESTIMATION: Nonparametric methods for estimation of power spectral density, autocorreleation, cross-correlation,transfer functions, and coherence form finite signal samples.

UNIT III

REVIEW OF SIGNAL PROCESSING: A review on random processes, Areview on filtering
random processes, Examples.

UNIT IV

STATISTICAL PARAMETER ESTIMATION: Maximum likehood estimation, maximum a
posterior estimation, Cramer-Rao bound.

UNIT V

EIGEN STRUCTURE BASED REQUENCY ESTIMATION: Pisarenko, MUSIC, ESPRIT their
application sensor array direction finding.

UNIT VI

SPECTRUM ESTIMATION: Moving average (MA), Auto Regressive (AR), Auto Regressive
Moving Average (ARMA), Various non-parametirc approaches.

UNIT VII

WIENER FILTERING: The finite impulse case, causal and non-causal infinite impulse responses cases.

UNIT VIII

ADAPTIVE SIGNAL PROCESSING: Least mean squares adaptation, recursive least squares adaptation, Kalman filtering.

TEXT BOOKS:

1. Steven M.Kay, fundamentals of statistical signal processing: estimation theory,Pretice-Hall,1993.
2. Monsoon H. Hayes, Stastical digital signal processing and modeling, USA, Wiley,1996.

REFERENCE BOOKS:

Dimitris G.Manolakis, Vinay K. Ingle, and Stephen M. Kogon, Statistical and adaptive signal processing, Artech House, Inc,2005, ISBN 1580536107

PROCESS CONTOL INSTRUMENTATION

UNIT-1

P & ID symbols. Process characteristics: Process load, Process lag, self-regulation.

Control system parameters: control lag, dead time, cycling.

Discontinuous controller modes: two position, multi position, floating control modes.

UNIT-2

Continuous controller modes: Mathematical representation and description of P, I, D controller modes. Composite control modes: Mathematical representation and description of PI, PD, PID control modes. Response of control modes to linear, step and square wave error signals.

UNIT-3

Electronic Controller mode implementation: Designing of P, PI, PD, PID using OP-amplifiers.

UNIT-4

Pneumatic controller mode implementation: Implementation of P, PI, PD, PID using flapper – nozzle system.

UNIT-5

Final control: Actuators – Electrical & Pneumatic. Control Valves – Quick opening, linear and equal percentage control valves, valve sizing. I to P, P to I converters.

UNIT-6

Programmable controllers: Ladder Diagram, Programmable controller program from the ladder diagram of a simple applications.

UNIT-7

Digital Controllers: Data logging, supervisory control, computer based controller.

UNIT-8

Control Loop Characteristics: Control System Quality, Loop disturbance, optimum control, stability. Process Loop tuning methods: Open-loop transient response method, Ziegler- Nichols method, frequency response methods.

Text Book:

1. Process control Instrumentation Technology by Curtis Johnson, 4 th Edition – PHI, Dec, 2000.

Reference Books:

1.Principles of Process control by D. Patranabis- TMH 2 nd Edition, 1996

2.P. Harriott, process control, Tata MoGraw – Hill publishing Co., Ltd., New Delhi, 1984.

PAPER – II

EMI/EMC

Unit I

Introduction: History and concept of EMI, Definitions of EMI/EMC, Electromagnetic environment, Practical experiences and concerns, frequency spectrum conservation, mechanisms of EMI generation, EMI testing, Methods of elimination of EMI and Biological effects of EMI

Unit II

Natural and manmade sources of EMI/EMC: Sources of Electromagnetic noise, typical noise paths, modes of noise coupling, designing for EM compatibility, lightening discharge, electro static discharge (ESD), electromagnetic pulse (EMP).

Unit III

EMI from Apparatus / Circuits and open area test sides: Electromagnetic emissions, oise form relays and switches, non-linearities in circuits, passive inter modulation, transients in power supply lines, EMI from power electronic equipment, EMI as combination of radiation and conduction.

Open area test sides: OATS measurements, measurement precautions.

Unit IV

Radiated Interference Measurements: anechoic chamber, TEM cell, reverberating chamber, GTEM cell, comparison of test facilities.

Unit V

Conducted Interference Measurement: Characterization of conduction currents / voltages, conducted EM noise and power line, conducted EMI from equipment, immunity to conducted EMI, characteristics of EMI filters and power line filter design.

Unit VI

Grounding and Cabling: Safety and signal grounds, low and high frequency grounding ethods, grounding of amplifiers and cable shields, isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding, types of cables, mechanism of EMI emission / coupling in cables.

Unit VII

Shielding and Bonding: effectiveness of shielding, near and far fields / impedances, methods of analysis, total loss due to absorption and reflection effects, composite absorption and reflection losses for electric fields / magnetic fields, magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets Electrical Bonding, Shape and Material for Bond straps, General Characteristics of good bonds.Unit VIII

Components for EMC and EMC Standards: Choice of capacitors, inductors, transformers and resistors, EMC design components

National / International EMC standards, military and civilian standards

Text Book:

1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT-Delhi, Modules 1-9.

References:

1. Introduction to Electromagnetic Compatibility, Ny, John Wiley, 1992, by C.R. Pal
2. Radar hand book by Skolink.

RF CIRCUIT DESIGN

UNIT I : INTRODUCTION TO RF ELECTRONICS

The Electromagnetic Spectrum, units and Physical Constants, Microwave bands – RF behavior of Passive components : Tuned resonant circuits, Vectors, Inductors and Capacitors – Voltage and Current in capacitor circuits – Tuned RF / IF Transformers.

UNIT II : TRANSMISSION LINE ANALYSIS

Examples of transmission line – Transmission line equations and Biasing – Micro Strip Transmission Lines – Special Termination Conditions – sourced and Loaded Transmission Lines.

SINGLE AND MULTIPORT NETWORKS

The Smith Chart, Interconnectivity networks, Network properties and Applications, Scattering Parameters.

UNIT III :MATCHING AND BIASING NETWORKS

Impedance matching using discrete components – Micro strip line matching networks, Amplifier classes of Operation and Biasing networks.

RF PASSIVE & ACTIVE COMPONENTS

Filter Basics – Lumped filter design – Distributed Filter Design – Diplexer Filters – Crystal and Saw filters Active Filters – Tunable filters – Power Combiners / Dividers – Directional Couples – Hybrid Couplers – Isolators. RF Diodes – BJTs-FETs-IIEMTs and Models.

UNIT IV : RF TRANSISTOR AMPLIFIER DESING

Characteristics of Amplifiers – Amplifier Circuit Configurations, Amplifier Matching Basics, Distortion and noise products, Stability Considerations, Small Signal amplifier design, Power amplifier design, MMIC amplifiers Broadband High Power multistage amplifiers, Lowe noise amplifiers, VGA Amplifiers.

UNIT V : OSCILLATORS

Oscillator basics, Low phase noise oscillator design, High frequency Oscillator configuration , LC Oscillators, VCOs, Crystal Oscillators, PLL Synthesizer, and Direct Digital Synthesizer.

RF MIXERS

Basic characteristics of a mixer – Active mixers – Image Reject and Harmonic mixers, Frequency, domain considerations.

TEXT BOOK :

1. RF circuit design: Theory and applications by Reinhold Ludwing, Pavel Bretchko. Pearson Education Asia Publication, New Delhi 2001.

REFERENCE BOOKS :

1. Radio frequency and microwave electronic illustrated Mathew M. Radmangh, 2001, PE Asia Publication.
2. Secrets of RF Design by Joseph Carr., 3rd Edition, Tab Electronics.
3. Complete Wireless Design by Cotter W. Sawyer, 2nd Edition, Mc-Graw Hill.
4. Practical RF Circuit Design for Modern Wireless Systems Vol. 2 by Less Besser and Rowan Gilmore.

DIGITAL DATA COMMUNICATIONS

UNIT I
DIGITAL MODULATION TECHNIQUES:
FSK , MSK , BPSK , QPSK , 8-PSK , 16-PSK , 8- QAM , 16- QAM , Band width efficiency
carrier recovery DPSK , clock recovery , Probability of error and bit error rate.

UNIT II
DATA COMMUNICATIONS: Serial, Parallel configuration, Topology, Transmission
modes, codes, Error Control, Synchronization, LCU.

UNIT III
Serial and Parallel Interfaces, Telephone Networks and Circuits, Data modems.

UNIT IV
Data Communication Protocols , Character and block Mode ,Asynchronous and Synchronous Protocols, public Data Networks , ISDN.

UNIT V
LOCAL AREA NETWORKS: token ring, Ethernet, Traditional, Fast and GIGA bit Ethernet, FDDI

UNIT VI
DIGITAL MULTIPLEXING : TDM , T1 carrier , CCITT , CODECS, COMBO CHIPS , North American Hierarchy , Line Encoding , T-carrier , Frame Synchronization Inter Leaving Statistical TDM FDM , Hierarchy ,Wave Division Multiplexing .

UNIT VII
WIRELESS LANS
IEEE 802.11 Architecture Layers, Addressing, Blue Tooth Architecture Layers, l2 Cap, Other Upper Layers .

UNIT VIII
MULTI MEDIA
Digitalizing Video and Audio Compression Streaming Stored and Live Video and Audio ,
Real Time Interactive Video and Audio , VOIP

TEXT BOOKS
1. Electronic communication systems, fundamentals through advanced - W. TOMASI, Pearson 4th Edition.
2. Data communication and networking - B.A. Forouzen

CODING THEORY & PRACTICE

UNIT-I

Information Theory : Entropy, Information rate,source coding : Shannon-Fano and Huffman coding techniques,Mutal Information, Channel capacity of Discrete Channel, Shannon- Hartly law, Trade-off between bandwidth and SNR.

UNIT II

Introduction and Overview Error Control Codes: Examples of the use of error control codes,basic notions,coding gain. Characterization of Error control codes performance of error control codes, comparision of uncoded and coded systems.

UNIT III

Convolution Codes: Convolution encoders , structural properties of convolution codes,Trelis Diagrams,Viterbi Algorithm, Perforrmance Analysis.

UNIT IV

Linear Block Codes: Linear block Codes and their properties, standard arrays, Syndromes,Weight Distribution. Error Detection/Correction Properties, Modified Linear block codes.

UNIT V

Finite Fields: groups, Rings, Fields Properties of finite Fields, Extension Fields, Polynomials over Finite Fields, Minimal Polynomials, Conjugates.

UNIT VI

Cyclic Codes : General theory, Shift Register Implementtions, Shortened Cyclic codes CRCs for Error Detection.

UNIT VII

BCH and RS Codes : Algebric Description, Frequency Domain Description, Decoding Algorithms for BCH and RS Codes.

UNIT VIII

Applications: Concatenated Codes, Interleaves, The Compact Disc, Codes for Magnetic recording.

TEXT BOOKS:

1. Stephen B.Wicker Error Control Systems for Digital Communication and storage, Prenticc Hall. 1995ISBN 0-13-200809-2
2. Kennedy, Electronic Communication systems, Mc Graw Hill.

REFERENCE BOOKS:

1. John Proakis, Digital Communications, TMH
2. Simon Haykin, Communication Systems.

ADVANCED COMPUTER ARCHITECTURE

UNIT I

Fundamentals of Computer design- Technology trends- cost- measuring and reporting performance quantitative principles of computer design.

UNIT II

Instruction set principles and examples- classifying instruction set- memory addressing- type and size of operands- addressing modes for signal processing-operations in the instruction set- instructions for control flow- encoding an instruction set.-the role of compiler.

UNIT III

Instruction level parallelism (ILP)- over coming data hazards- reducing branch costs – high performance instruction delivery- hardware based speculation- limitation of ILP.

UNIT IV

ILP software approach- compiler techniques- static branch protection- VLIW approach- H.W support for more ILP at compile time- H.W verses S.W solutions.

UNIT V

Memory hierarchy design- cache performance- reducing cache misses penalty and miss rate – virtual memory- protection and examples of VM.

UNIT VI

Multiprocessors and thread level parallelism- symmetric shared memory architectures- distributed shared memory- Synchronization- multi threading.

UNIT VII

Storage systems- Types – Buses - RAID- errors and failures- bench marking a storage device- designing a I/O system.

UNIT VIII

Inter connection networks and clusters- interconnection network media – practical issues in interconnecting networks- examples – clusters- designing a cluster

TEXT BOOKS

1. Computer Architecture A quantitative approach 3rd edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier)

REFERENCES

1. Computer Architecture and parallel Processing - Kai Hwang and A.Briggs International Edition McGraw-Hill.
2. Advanced Computer Architectures, Dezso Sima, Terence Fountain, Peter Kacsuk,

MICROCOMPUTER SYSTEM

DESIGN Unit – I

Overview of microcomputer systems, Historical background, Von Neumann architecture, instruction processing, fetch and execute cycles, evolution of Intel 80x86 family of microprocessors. Architectural advances of Intel XX86 Microprocessors series from 8086 to Pentium and Pentium Pro-Addressing Modes, Instruction sets, Interrupt Processing.

Unit – II

Software model of XX86 processors, Data organization, Memory Organization, Programming with DOS and BIOS function calls.

Unit – III

8086 Processor Architecture
CPU Architecture – Programmer's model, 8086 hardware details – Pinouts and Pin function, Clock generator (8284A), Bus buffering and latching, System bus timing - Processor Read & Write bus cycles, Ready and wait state, Minimum and Maximum mode operations.

Unit – IV

Virtual Memory Management: Virtual memory concept paging, segmentation, paging algorithms, cache memory organization, Associate memory organization.

Unit –V

Memory Interfacing
Basic Concepts, Memory devices – ROM, SRAM, DRAM devices, Memory pin connections, Memory read and write timing diagrams, Address decoding techniques – Random logic (using Logic gates) decoding, block decoding (using 74LS138, 74LS139 decoders), PROM address decoding, PLD programmable decoding (using PLAs & PALs), 8086 processor-Memory interfacing – even and odd memory banks.

Unit –VI

Basic I/O Interfacing
Basic Concepts, Parallel I/O, Programmed I/O, I/O port address decoding, The 8255A Programmable Peripheral Interface(PPI), Interface examples – Keyboard matrix interface, Printer interface and display interface, The 8254 Programmable Interval Timer (PIT).
Interrupts & Direct Memory Access
Basic concepts, Interrupt driven I/O, Software & Hardware interrupts, Interrupt vectors and vector table, Interrupt processing.

Unit – VII

The 8259A Programmable Interrupt Controller (PIC), Basic DMA operation, The 8237 DMA Controller.

Serial I/O Communication

Basic concepts, Asynchronous & Synchronous communication. Physical communication standard-EIA RS232, Programmable communication interface – Universal Asynchronous Receiver / Transmitter.

Unit – VIII

RISC & CISC Concepts, Super scalar architecture, Pipelining, Branch Prediction, Instruction and data caches, Floating point unit.

TEXT BOOKS

1. Barry B. Brey: The Intel Microprocessors 8086/8088, 80188, 80386, 80486, Pentium-Pro Processor Architecture, Programming & Interfacing (PHI) 4th Edn. 1997.
2. John Uffenbeck: The 8086/8088 family design, Programming & Interfacing, (PHI).

References:

1. Microprocessor and Interfacing - Dougles V. Hall.

NEURAL NETWORKS AND APPLICATIONS

UNIT I

FUNDAMENTAL CONCEPTS AND MODELS OF ARTFICIAL NEURAL SYSTEMS Biological Neuron, Biological Neuron Models and their artificial rnodeIs~ McCufloch~Pitts Neuron Model, Neuron Modeling for Artificial Neuron Models Neuron Systems~ Models of Artificial Neural Networks; Feed forward Network and feed backward Network. Neural Processing,, learning and adaptatiom Supervised and Un Supervised learning

UNIT II

NEURAL NETWORK LEARNING RULES

Hebbian Learning Rule. Perceptron Learning Rule. Delta Learning Rule Widrow4laff Rule~Correlation Learning Rule, Winner —Take-All Learning rule, Out Star Learning Rule,summary of Learning rules.

UNIT III

SINGLE LAYER PERCEPTRON CLASSIFIERS

Classification Model Features and Decision Regions, Diseriminant Functions , Jinear Machine and Minimum Distance Classification,, Nonparametiic training concept Training and classification using the discrete perceptron~ algorithm and example~ Single Layer Continuous Perceptron Networks for Linearly Separable Classifications~ Multicategory Single Layer Perceptron Networks~

UNIT IV

MULTILAYER FEED FORWARD NETWORKS

Linearly aonsepa~table pattern classification Delta Learning rule for ~MuhipereeptrOfl layer~ (ienerall?ed Delta Learning rule. Feed forward Recall and Error Back Propagation Training; Examples oF Error l3ack-Propagatiort Training errors: Learning Factors; Initial weights,Cumulative Weight Adjustment versus Incremental Updating, steepness of activation function, learning constant, momentum method, Network architecture Versus Data Representation, Necessary number of Hidden Neurons~ Application of Rack propagation Networks in pattern recognition & Image processing, Madaunes: Architectute & Algouithms~

UNIT V

SINGLE-LAYER FEEDBACK NETWORKS

Basic concepts of Dynamical systems. Mathematical Foundation of Discrete~Time Hop field Networks. Mathematical Foundation of Gradientiype Hopfiekl ~4etworks~ Transient response of Continuous time Networks~ Example Solution of Optimization Problems:Summing networks with digital outputs. Minimization of the Traveling salesman tour length,Solving Simultaneous Linear Equations~

UNIT VI

ASSOCIATIVE MEMORIES-I

Basic concepts~ Linear assocIator Basic concepts of Recurrent Auto associative memQty Retrieval algorithm. Storage algorithm. StQrage Algorithms Performance considerations.Performance concepts ni Recurrent Auto associative memory; Energy Function ~Red~tiofl ,capacity of Recurrent Auto associative memory, Memory

convergence versus Couup~ion fixed point concept, modified memory Convergence towards fixed points, advantagea and I imitations.

UNIT VII

ASSOCIATIVE MEMORI ES-II

Boltzman machines, Bidirectional Associative Memory; Memory architecture, association encoding and decoding, stability considerations, memory examplec and •pertbnnancc evaluation, improved coding of memories, multidirectional Associati\e Memory. Associative Memory of Spatio-temporal Patterns

UNIT VIII

MATCHING AND SELF-ORGAN1ZlNG NETWORKS: hamming net and MAXNE F Unsupervised learning of clusters. Clustering and similarity measures Winnerl take all learning ,recall mode, initialization of weigMs. separahihty limitations. Counter propagation networks, feature mapping: Self organizing Idature maps, LVPS, Cluster discovep, netwnrks(ART 1 1.

TEXT BOOKS:

1. JM,Zurada: Introduction to Artificial Neural Systems, Jaico Puhlndwrs
2. Dr. B. Yagananarayana. Artificial Neural Networks, PU!, New Delhi.

REFERENCES:

1. Kishan Mehrotra. Chelkuri K. Mohan. Sanjay Ranks: Elements of Artificial Neural Networks, Penram International
2. Artificial Neural Network l4y Simon Flaykin, Pearson Education
3. Introduction Neural Networks Using MA1'LAB 6,1 - hs S N. Shisanandam, S. Sumati, S. N. Deepaj/e, TMH, New Delhi.
4. Fundamental of Neural Networks By Laurene Fausett

NEURAL NETWORKS & FUZZY SYSTEMS

Unit-I Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit-II Essentials of Artificial Neural Networks

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN-Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

Unit-III Feed Forward Neural Networks

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer Feed Forward Neural Networks

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backporpagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Unit-IV Associative Memories

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

Unit-V Self-Organizing Maps (SOM) and Adaptive Resonance Theory (ART)

Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability- Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.

Unit-VI Classical & Fuzzy Sets

Introduction to classical sets – properities, Operations and relations; Fuzzy sets, Membership, Uncertainity, Operations, Properities, fuzzy relations, cardinalities, membedship functions.

Unit-VII Fuzzy Logic System Components

Fuzzification, Membership Value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Unit-VIII Applications

Neural network applications: Process identification, Fraction Approximation, Control

and Process Monitoring, Fault diagnosis and Load forecasting.
Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOK:

1. Neural Netwroks, Fuzy logic , Gnenetic algorithms: synthesis and applications by Rajasekharan and Rai- PHI Publication.
2. Introduction to Artificial Neural Systems- Jacek M.Zurada, Jaico Publishing House, 1997.

REFERENCE BOOKS:

1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. Bapi Raju, Pearson Education
2. Neural Netwroks – James A Freeman and Davis Skapura, Pearson, 2002
3. Neural Netwroks – Simon Hykins, Pearson Education.
4. Neural Engineering by C. Eliasmith and CH. Anderson, PHI.
   Neural Netwroks and Fuzzy Logic System by Brok Kosko, PHI Publications

ALGORITHMS FOR VLSI DESIGN AUTOMATION

UNIT I

PRELIMINARIES: Introduction to Design Methodologies, Design Automation tools, Algorithmic Graph Theory, Computational Complexity, Tractable and Intractable Problems

UNIT II

GENERAL PURPOSE MTHODS FOR COMBINATIONAL OPTIMIZATION: Backtracking, Branch and Bound, Dynamic Programming, Integer Linear Programming, Local Search, Simulated Annealing, Tabu search, Genetic Algorithms.

UNIT III

Layout Compaction, Placement, Floorplanning and Routing Problems, Concepts and Algorithms

UNIT IV

MODELLING AND SIMULATION: Gate Level Modelling and Simulation, Switch level modeling and simulation

UNIT V

LOGIC SYNTHESIS AND VERIFICATION: Basic issues and Terminology, Binary – Decision diagram, Two – Level Logic Sysnthesis.

UNIT VI

HIGH LEVEL SYNTHESIS: Hardware Models, Internal representation of the input algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithms, Some aqspects of Assignment problem, High – level Transformations.

UNIT VII

PHYSICAL DESIGN AUTOMATION OF FPGA'S: FPGA technologies,Physical Design cycle for FPGA's partitioning and Routing for segmented and staggered models.

UNIT VIII

PHYSICAL DESIGN AUTOMATION OF MCM'S: MCM technologies, MCM physical design cycle, Partitioning, Placement – Chip array based and full custom approaches, Routing – Maze routing, Multiple stage routing, Topologic routing, Integrated Pin – Distribution and routing, routing and programmable MCM's.

TEXT BOOKS:

1. Algorithms for VLSI Design Automation, S.H.Gerez, WILEY student edition, John wiley & Sons (Asia) Pvt.Ltd. 1999.
2. Algorithms for VLSI Physical Design Automation, 3rd edition, Naveed Sherwani, Springer International Edition, 2005

REFERENCES:

1. Computer Aided Logical Design with Emphasis on VLSI – Hill & Peterson, Wiley, 1993
2. Modern VLSI Design: Systems on silicon – Wavne Wolf, Pearson Education Asia, 2nd Edition, 1998

DIGITAL SYSTEM DESIGN

UNIT – I
DESIGN OF DIGITAL SYSTEMS: ASM charts, Hardware description language and control sequence method, Reduction of state tables, state assignments.

UNIT – II
SEQUENTIAL CIRCUIT DESIGN: design of Iterative circuits, design of sequential circuits
using ROMs and PLAs, sequential circuit design using CPLD, FPGAs.

UNIT – III
FAULT MODELING: Fault classes and models – Stuck at faults, bridging faults, transition and intermittent faults. TEST GENERATION: Fault diagnosis of Combinational circuits by conventional methods – Path Sensitization technique, Boolean difference method, Kohavi algorithm.

UNIT – IV
TEST PATTERN GENERATION: D – algorithm, PODEM, Random testing, transition count testing, Signature analysis and testing for bridging faults.

UNIT – V
FAULT DIAGNOSIS IN SEQUENTIAL CIRCUITS: State identification and fault detection
experiment. Machine identification, Design of fault detection experiment.

UNIT – VI
PROGRAMMING LOGIC ARRAYS: Design using PLA's, PLA minimization and PLA folding.

UNIT – VII
PLA TESTING: Fault models, Test generation and Testable PLA design.

UNIT – VIII
ASYNCHRONOUS SEQUENTIAL MACHINE: fundamental mode model, flow table, state
reduction, minimal closed covers, races, cycles and hazards.

TEXT BOOKS:
1. Z. Kohavi – "Switching & finite Automata Theory" (TMH)
2. N. N. Biswas – "Logic Design Theory" (PHI)
3. Nolman Balabanian, Bradley Calson – "Digital Logic Design Principles" – Wily Student Edition 2004.

REFRENCE BOOKS:
1. M. Abramovici, M. A. Breues, A. D. Friedman – "Digital System Testing and Testable Design", Jaico Publications
2. Charles H. Roth Jr. – "Fundamentals of Logic Design".
3. Frederick. J. Hill & Peterson – "Computer Aided Logic Des
ign" – Wiley 4th Edition. 4

ANALOG AND DIGITAL IC DESIGN

UNIT-I

OPERATIONAL AMPLIFIERS: General considerations one – state op-amps, two stage op-amps-gains boosting stage- comparison I/P range limitations slew rate. CURRENT MIRRORS AND SINGLE STAGE AMPLIFIERS: simple COMS, 3JT current mirror,, Cascode

Wilson Wilder current mirrors. Common Source amplifier source follower, common gate amplifier

NOISE: Types of Noise – Thermal Noise-flicker noise- Noise in opamps- Noise in common source stage noise band width.

UNIT-II

PHASED LOCKED LOOP DESIGN: PLL concepts- The phase locked loop in the locked condition Integrated circuit PLLs – phase Detector- Voltage controlled oscillator case study: Analysis of the 560 B Monolithic PLL.

SWITHCHED CAPACITORS CIRCUITS: Basic Building blocks op-amps capacitors switches – non-over lapping clocks-Basic operations and analysis-resistor equivalence of la switched capacitor- parasitic sensitive integrator parasitic insensitive integrators signal flow graph analysis-First order filters- switch sharing fully differential filters – charged injections-switched capacitor gain circuits parallel resistor –capacitor circuit – preset table gain circuit – other switched capacitor circuits – full wave rectifier – peak detector sinusoidal oscillator.

UNIT-III

LOGIC FAMILIES & CHARACTURISTICS : COMS, TTL, ECL, logic families COMS / TTL, interfacing comparison of logic families.

COMBINATIONAL LOGIC DESIGN USING VHDL: VHDL modeling for decoders, encoders, multiplexers, comparison, adders and subtractors .

SEQUENCIAL IC DESIGN USING VHD: VHDL modeling for larches, flip flaps, counters, shift registers, FSMs.

UNIT-IV

DIGITAL INTEGRADED SYSTEM BUILDING BLOCKS: Multiplexers and decoders –barrel shifters counters digital single bit adder

MEMORIES: ROM: Internal structure 2D decoding commercial type timing and applications

CPLD: XC 9500 series family CPLD architecture – CLB internal architecture, I/O block internal structure .

FPGA: Conceptual of view of FPGA – classification based on CLB internal architecture I/O block architecture.

UNIT-V

COMPORATORS: Using an op-amp for a comparator-charge injection errors- latched comparator

NYQUIST RATE D/A CONVERTERS: Decoder based converter resistor storing converters folded resister string converter – Binary scale converters – Binary weighted

resistor converters – Reduced resistance ratio ladders – R-2R based converters – Thermometer code current mode D/A converters.

NYQUIST RATE A/D CONVERTERS: Integrating converters – successive approximation converters. DAC based successive approximation – flash converters time interleaved A/D converters.

REFERENCES:

1. Analog Integrated circuit Design by David A Johns, Ken Martin, John Wiley & Sons.
2. Analysis and design of Analog Integrated Circuits, by Gray, Hurst Lewis, Meyer. John Wiley & Sons.
3. Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH
4. Digital Integrated Circuit Design by Ken Martin, Oxford University 2000
5. Digital Design Principles & Practices" by John F Wakerly, Pearson Education & Xilinx Design Series, 3rd Ed.(2002)

SUGGESTING READOMG

1. Ken Martin, Digital Integrated Circuit Design Oxford University,2000.
2. John F Wakerly, "Digital Design Principles & Practices", Pearson Education & Xilinx Design Series, 3rd Ed.(2002)
3. Samir Palnitkar, "Verylog HDL-A Guide to Digital Design and Synthesis", Prentice Hall India, (2002)
4. Douglas J Smith, "HDL Chip Design, a practical Guide for Designing, Synthesizing and simulating ASICs and FPGAs using VHDL or Verilog, Doone Publications, (1999).

EMBEDDED SYSTEM DESIGN

Unit – I

An introduction to embedded systems: An embedded system, examples, current technologies, integration in system design, embedded system design flow, hardware design concepts, software development, processor in embedded system and other hardware units, introduction to processor based embedded system design concepts.

Unit – II

Devices in embedded system: I/o devices, timer and counting devices, ROM devices, serial communication devices and parallel communication devices, interrupts and their control of processors.

Unit – III

Programming concepts: Data types, data structures, modifiers, macros, functions, optimization of memory needs, embedded system tools – hardware and software development tools.

Unit – IV

Program modeling concepts: Modeling process for software analysis, modeling of multi processor system, software algorithm concepts, software design, implementation and testing, validating and debugging, maintenance.

Unit – V

Software design: Survey of software architecture – round robin, round robin with interrupts, function queue scheduling architecture, real time operating system architecture, selecting an architecture saving memory space, getting embedded software in target system, debugging technique.

Unit – VI

Device drivers and interrupts servicing mechanism: Device drivers, parallel port and serial port drivers in a system, device drivers for internal programmable timing devices, interrupt servicing mechanism, dynamically linked libraries (DLL), context switching, latency principles.

Unit – VII

Hardware and software co-design in embedded systems: Embedded system design and co-design issues, design cycle in development phase, ICE, issues in embedded system design.

Unit – VIII

Embedded system design examples: Case studies – design of embedded systems using Xillinx processor based design i.e. power PC processor based embedded design, Micro blaze processor based embedded design, Altera based Nios processor embedded system design.Text Books:

a) Rajkamal, “Embedded system: Architecture, programming and design”, TMH.
b) Frank Vahid, Tony D. Givargis, “Embedded system design: A unified hardware / software introduction”, John wiley & sons Inc. 2002.

Reference Books:David E Simon, “ An embedded software primer”.

(a) Arnold S Burger, “Embedded system design”, CMP.

EMBEDDED AND REAL TIME SYSTEMS

UNIT I: INTRODUCTION

Embedded systems over view, design challenges, processor technology, Design technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic(RT-level), custom purpose processor design(RT -level), optimizing custom single purpose processors.

UNIT II: GENERAL PURPOSE PROCESSORS

Basic architecture, operations, programmer's view, development environment, Application specific Instruction –Set processors (ASIPs)-Micro controllers and Digital signal processsors.

UNIT III: STATE MACHINE AND CONCURRENT PROCESS MODELS

Introduction, models Vs Languages, finite state machines with data path model(FSMD),using state machines, program state machine model(PSM, concurrent process model, concurrent processes, communication among processes, synchronization among processes, Implementation, data flow model, real-time systems.

UNIT IV: COMMUNICATION PROCESSES

Need for communication interfaces, RS232/UART, RS422/RS485,USB, Infrared, IEEE1394 Firewire, Ethernet, IEEE 802.11, Blue tooth.

UNIT V: EMBEDDED/RTOS CONCEPTS-I

Architecture of the Kernel, Tasks and task scheduler, interrupt service routines, Semaphores, Mutex.

UNIT VI: EMBEDDED/RTOS CONCEPTS-II

Mailboxes, Message Queues, Event Registers, Pipes-Signals.

UNIT VII: EMBEDDED/RTOS OCNCEPTS-III

Timers-Memory Management-Priority inversion problem-embedded operating systems-Embedded Linux-Real-time operating systems-RT Linux-Handheld operating systems-Windows CE.

UNIT VIII: DESIGN TECHNOLOGY

Introduction, Automation, Synthesis, parallel evolution of compilation and synthesis, Logic synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hard ware/Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.

TEXT BOOKS

1.Embedded System Design-A Unified Hardware/Software Introduction- Frank Vahid, Tony D.Givargis, John Wiley & Sons, Inc.2002.
2. Embedded/Real Time Systems- KVKK prased, Dreamtech press-2005.
3. Introduction to Embedded Systems - Raj Kamal, TMS-2002.

REFERENCE BOOKS

1. Embedded Microcomputer Systems-Jonathan W.Valvano, Books/Cole,Thomson Leaarning.
2. An Embedded Software Primer- David E.Simon, pearson Ed.2005

Image and Video Processing

1. Introduction to Image processing system & Image transforms

Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing

Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.

2. Image Enhancement and Image Restoration

Introduction to image enhancement, Enhancement in spatial domain, enhancement through point operation, Types of point operation, Histogram manipulation, Linear Gray level transformation, Nonlinear Gray level transformation, Local or neighbourhood operation, Median filter, Image sharpening, Bit plane slicing, Image enhancement in the frequency domain.

Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution

3. Image segmentation and Image compression

Introduction to image segmentation, Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour

Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression

4. Colour Image processing

Introduction, Light and colour, colour formation, Human perception of colour, colour model The chromaticity diagram, colour image quatization, Histogram of colour image, colour image filtering, Gamma correction of a colour image, colour image segmentation

5. Video Formation, Perception, and Representation

Video capture and display, Analog video raster, Analog colour television systems, Digital video

6. Video sampling & Video modeling

Basics of Multidimensional Continuous space signals and systems, Discrete space signals and systems, Basics of Lattice theory, Sampling over lattices, sampling of

video signals, Filtering operations in cameras and display devices, Conversion of signals sampled on Different lattices, Sampling rate conversion of video signals
Camera Model, Illumination model, Object model, Scene model, Two dimensional motion models

7. Two Dimensional motion estimation

Optical flow, General methodologies, Pixel based motion estimation, Block Matching algorithm, Deformable block matching algorithms, Mesh based motion estimation, Global motion estimation, Region Based motion estimation, Application of motion estimation in video coding

8. Foundation of Video coding

Overview of coding systems, Basic notions in probability and information theory, Information theory for source coding, Binary coding, Scalar Quantization, Vector quantization

Block based transform coding and Predictive coding

Text Books:

1. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, Tata Mc Graw Hill publishers, 2009
2. Yao Wang,Jorn Ostermann and Ya Qin Zhang "Video processing and Communications" Prentice Hall Publishers ,2002, ISBN 0-13-017547-1

Reference Books:

1. R.Gonzalez, R.E.Woods, "Digital Image Processing", 3rd Edition, Pearson Education, India, 2009.
2. John W.Woods, "Multidimensional Signal, Image and Video Processing and Coding"Elsevier Academic Press Publications2006, ISBN-13: 978-0-12–088516-9 .

ADVANCED DIGITAL SIGNAL PROCESSING

UNIT I

DISCRETE FOURIER TRANSFORMS: Properties of DFT, Linear Filtering methods based on the DFT, Overlap-save, Overlap -Add methods, frequency analysis of signals.

UNIT II

FAST FOURIER TRANSFORMS : Radix-2 FFT and Split- Radix FFT algorithms The Goertzel and Chirp Z transform algorithms

UNIT III

DESIGN OF IIR FILTERS: Design of IIR filters using Butterworth & Chebyshev approximations, frequency transformation techniques, structures for IIR systems – cascade, parallel, lattice & lattice-ladder structures.

UNIT IV

DESIGN OF FIR FILTERS: Fourier series method, Windowing techniques, design of digital filters based on least – squares method, pade approximations, least squares design, wiener filter methods, structures for FIR systems –cascade, parallel, lattice & lattice-ladder structures.

UNIT V

MULTI RATE SIGNAL PROCESSING : Decimation by a factor D, Interpolation by a factor I ,Sampling rate conversion by a rational factor I/D, Filter design & Implementation for sampling rate conversion.

UNIT VI

POWER SPECTRAL ESTIMATION: Estimation of spectra from finite duration observation of signals, Non-parametric methods :Bartlett ,Welch & Blackmann & Tukey methods.

UNIT VII

PARAMETRIC METHODS FOR POWER SPECTRUM ESTIMATION: Relation between auto correlation & model parameters, Yule-Waker & Burg Methods, MA & ARMA models for power spectrum estimation.

UNIT VIII

Analysis of finite wordlength effects in fixed-point DSP systems – Fixed ,Floating Point Arhimetic – ADC quantization noise & signal quality – Finite wordlength effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

TEXTBOOKS

1. Digital Signal Processing –Principles, Algorithms Applications by J.G.Proakis & D.G.Manolokis, PHI.
2. Discrete Time signal processing - Alan V Oppenheim & Ronald W Schaffer, PHI.
3. DSP – A Pratical Approach – Emmanuel C.Ifeacher Barrie. W. Jervis, Pearson Education.

REFERENCES

1. Modern spectral Estimation techniques by S. M .Kay, PHI, 1997

DIGITAL CONTROL SYSTEMS

Unit – 1

Introduction: Basic Elements of discrete data control systems, advantages of discrete data control systems, examples.

Unit – 2

Signal conversion & processing: Digital signals & coding, data conversion & quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold and polygonal hold.

Unit – 3

Review of z-Transforms, Applications of z-Transforms to Difference equations and ladder Network problem, Signal between sampling instants using sub multiple sampling method, Modified z- Transforms.

Unit – 4

Transfer functions, Block diagrams, signal flow graphs: Introduction, Pulse Transfer function, and z-Transfer function, Discrete Data System with cascaded elements separated by a sampler and not separated by a sampler. Closed loop systems, characteristic equation in discrete domain, causality and physically realizable systems; The Sampled signal flow graph, Modified z-transfer function, Multirate discrete data systems (slow rate and fast rate), closed loop multirate sampled systems.

Unit – 5

Comparison of time response of continuous data and discrete data, Steady state error analysis of digital control systems, correlation between time response and root locations in s-plane and z-plane, Root loci for digital control systems, Effects of adding poles and zeros to open loop transfer function, discrete data systems: Stability tests of discrete data systems: Bilinear transformation method, extension of RH criterion, Jury's Stability Test.

Unit – 6

Frequency – Domain Analysis: Polar plot of GH (z), Nyquist stability criterion, Bode plot, Gain Margin and Phase margin, Nicholas chart, Band width considerations, sensitivity analysis.

Unit – 7

Review of state space techniques to continuous data systems, state equations of discrete data systems with sample and hold devices, state diagrams of digital systems, Decomposition of discrete data transfer function, state variable analysis of response between sampling instants, Controllability, Observability of LTI discrete data systems.

Unit – 8

Design of digital control systems with digital controllers through bilinear transformation. Digital PID controller, Design for dead beat response, pole placement design by incomplete feedback or output feedback.

Text Book:
1.Digital control systems (Second Edition) by Kuo, Oxford University Press
2.Discrete Time control systems – by Ogatta,
2nd ed. (PHI) Reference:

1.Digital Control Engineering – by M. Gopal, (New Age Publ.)
2.Control System Engineering – by Nagrath & Gopal (Wiley Eastern)
3.Continuous & Discrete Control Systems – by John Dorsey (MGH)