

**ANNA UNIVERSITY COIMBATORE**

**REGULATIONS 2007-08**

**B.E - ELECTRONICS & COMMUNICATION ENGINEERING**

**SEMESTER V**

<b>Code No.</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>M</b>	<b>C</b>
<b>THEORY</b>						
	Principles of Management	4	1	0	100	5
	Communication Theory	3	1	0	100	4
	Digital Signal Processing	3	1	0	100	4
	Microprocessors and applications	3	0	0	100	3
	Control Systems	3	1	0	100	4
	Computer Networks	3	1	0	100	4
<b>PRACTICAL</b>						
	Communication Skills & Personality Development- II	0	0	3	100	1.5
	Digital Signal Processing Lab	0	0	3	100	1.5
	Computer Networks Lab	0	0	3	100	1.5

**SEMESTER VI**

<b>Code No.</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>M</b>	<b>C</b>
<b>THEORY</b>						
	VLSI Design	3	0	0	100	3
	Digital Communication	3	1	0	100	4
	Microcontrollers	3	1	0	100	4
	Antenna and Wave Propagation	3	1	0	100	4
	Digital Image Processing	3	0	0	100	3
	Elective I	3	0	0	100	3
<b>PRACTICAL</b>						
	Analog and Digital Communication Systems Lab	0	0	3	100	1.5
	VLSI Design Lab	0	0	3	100	1.5
	Microprocessor and Microcontroller Lab	0	0	3	100	1.5

## SEMESTER V

### PRINCIPLES OF MANAGEMENT

L	T	P	M	C
4	1	0	100	5

#### UNIT-I FOUNDATIONS

9

Historical developments – approaches to management – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organization-

#### UNIT-II MANAGERS & ENVIRONMENT

9

Social responsibility – Planning – Objectives – Setting Objectives – Process of Managing through Objectives – Strategies- Policies & Planning Premises- Forecasting – Decision-making-

#### UNIT-III FUNCTIONAL AREA OF ORGANISATION

9

Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness-

#### UNIT –IV MOTIVATION & DIRECTIONS

9

Objectives – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication

#### UNIT-V CONTROLLING STRATEGIES

9

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology – Computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management-

**TOTAL : 45**

#### REFERENCES:

1. Harold Koontz & Heinz Weihrich “Essentials of Management”- Tata McGraw-Hill-7<sup>th</sup> Edition-2007.
2. Joseph L Massie “Essentials of Management”- Prentice Hall of India- (Pearson) 4<sup>th</sup> Edition- 2003.
3. Tripathy PC And Reddy PN- “ Principles of Management”- Tata McGraw-Hill- 1999.
4. Decenzo David- Robbin Stephen A- ”Personnel and Human Resources Management”- Prentice Hall of India- 1996 .
5. Robbins-“ Principles of Management” Pearson education -2005.

## COMMUNICATION THEORY

L	T	P	M	C
3	1	0	100	4

### UNIT I INTRODUCTION

9

Basic representation of communication system – Transmitter- Channel- Noise and Receiver- Baseband and band pass signal- Transmission media- bandwidth and capacity- Electromagnetic spectrum- Bandwidth requirements- Spectra of sinusoidal and non sinusoidal waves- Analog versus digital communication

### UNIT II AMPLITUDE MODULATION

9

Need for modulation- Amplitude Modulation- Definition- single tone modulation- Phasor representations- power relations in AM waves- Generation of AM waves- Detection of AM Waves- DSB MODULATION : Double side band suppressed carrier modulators- time domain and frequency domain description- Generation of AM SSB Modulated Wave - Demodulation of SSB Waves- principles of Vestigial side band modulation

### UNIT III ANGLE MODULATION

9

Basic concepts- Frequency Modulation: Single tone frequency modulation- Spectrum Analysis of Sinusoidal FM Wave- Narrow band FM- Phasor representation - Wide band FM- Constant Average Power- Transmission bandwidth of FM Wave - Generation of FM Waves- Direct and Indirect FM- Detection of FM Waves: Balanced Slope detector- Foster Seeley discriminator- Ratio detector- Phase locked loop method of FM detection- Comparison of FM & AM.

### UNIT IV RADIO TRANSMITTERS AND RECEIVERS

9

Radio Transmitter - Classification of Transmitter- AM Transmitter- FM Transmitter – Variable reactance type and phase modulated FM Transmitter- frequency stability in FM Transmitter- Radio Receiver - Receiver Types - Tuned radio frequency receiver- Super heterodyne receiver- RF section and Characteristics - Frequency changing and tracking- Intermediate frequency- AGC- FM Receiver- Amplitude limiting- Comparison with AM Receiver

### UNIT V NOISE

9

Thermal noise- Shot noise- Partition noise- Atmospheric noise -Noise figure- Calculation of noise figure- noise bandwidth- Equivalent noise resistance - Noise figure of cascaded stages- noise figure measurement- Noise temperature- available Noise Power  
Noise in Analog communication System- Noise in DSB, SSB, AM and FM Systems - Threshold effect in FM System- Pre-emphasis & De-Emphasis in FM.

**TOTAL : 45**

**REFERENCES:**

1. Principles of Communication Systems – H Taub & D- Schilling- Gautam Sahe- Tata McGraw Hill- 2007 3<sup>rd</sup> Edition.
2. Communication Systems - Simon Haykin- John Wiley- 4<sup>th</sup> Edition 2001.
3. Communication Systems – B-P- Lathi- BS Publication- 2006.
4. Electronics & Communication System – George Kennedy and Bernard Davis- Tata McGraw Hill 2004.
5. Electronic Communication Systems Fundamentals through Advanced – Wayne Tomasi- 5<sup>th</sup> Edition- Pearson Education Inc-. 2004.
6. Fundamentals of Communication Systems, Proakis and Salehi, Pearson Education. 2004
7. Communication Systems Engineering, 2<sup>nd</sup> Ed., Proakis & Salehi, Pearson/Prentice Hall 2001.

## DIGITAL SIGNAL PROCESSING

L	T	P	M	C
3	1	0	100	4

### UNIT I FAST FOURIER TRANSFORM

9

Introduction to DFT – Efficient computation of DFT- Properties of DFT – FFT algorithms – Radix-2 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms –fast convolution- overlap save method.

### UNIT II FINITE IMPULSE RESPONSE DIGITAL FILTERS

9

Amplitude and phase responses of FIR filters – Linear phase filters – Windowing techniques for design of linear phase FIR filters: Rectangular- Hamming- Hanning- Blackman and Kaiser Windows. Gibbs phenomenon –principle of frequency sampling technique- principle of optimum equiripple approximation. Realization - FIR filters.

### UNIT III INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Review of design of analogue Butterworth and Chebychev Filters- Frequency transformation in analog domain – Design of IIR digital filters using impulse invariance technique – Design of IIR digital filters using bilinear transformation – pre warping – Frequency transformation in digital domain – Realization - Direct form I, Direct form II, cascade and parallel.

### UNIT IV FINITE WORD LENGTH EFFECTS

9

Quantization noise – derivation for quantization noise power – Binary fixed point and floating point number representations – Comparison – truncation and rounding error – input quantization error-coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling.

### UNIT V DIGITAL SIGNAL PROCESSORS

9

Architectural Features – DSP Building Blocks – Multiplier- Shifter- MAC Unit- ALU –Bus Architecture and Memory – Addressing Modes – Address Generation Unit -Hardware architecture – pipelining- Overview of instruction set of TMS320C50.

**TOTAL: 45**

### TUTORIAL: 15

### REFERENCES

1. John G Proakis- Dimtris G Manolakis- Digital Signal Processing Principles- Algorithms and Application- Pearson/PHI- 4<sup>th</sup> Edition- 2007-
2. S.K.Mitra- "Digital Signal Processing- A Computer based approach"- Tata McGraw-Hill- 1998- New Delhi
3. Allan V.Openheim, Ronald W.Shafer & John R.Buck-"Discrete Time Signal Processing",second edition-Pearson/Prentice Hall.
4. B.Venkataramani & M-Bhaskar- Digital Signal Processor Architecture- Programming and Application- TMH 2002-
5. Johny R-Johnson: Introduction to Digital Signal Processing- Prentice Hall- 1984
6. Emmanuel Ifeachor "Digital Signal Processing: A Practical Approach", 2/E -Prentice Hall-2002



## CONTROL SYSTEMS

L	T	P	M	C
3	1	0	100	4

### UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Open loop and closed loop systems – Electrical analogy of mechanical- hydraulic and thermal systems- Transfer function of DC generator- DC servomotor- stepper motor and Synchro- Block diagram reduction techniques - Signal flow graphs – Mason's gain formula.

### UNIT II TIME RESPONSE ANALYSIS 10

Standard Test signals –Time response of first and second order systems- Performance criteria- Type of systems- Steady state error constants – position- velocity and acceleration error constants- Generalized error series–Feedback characteristics of control systems-Basics of P-PD-PI-PID controllers.

### UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency domain specifications – peak resonance- resonant frequency- bandwidth and cut-off rate- correlation between time and frequency responses for second order systems- Polar plot- Bode plot – Gain Margin and Phase Margin.

### UNIT IV STABILITY OF SYSTEMS 9

Characteristic equation – Location of roots of characteristic equation – Absolute stability and Relative stability- Routh Hurwitz criterion of stability – Necessary and sufficient conditions- Root locus construction – Effect of pole- zero addition – principle of argument - Nyquist stability criterion- Assessment of relative stability- Bode Plot – Assessment of stability.

### UNIT V STATE VARIABLE ANALYSIS 8

Introduction to state space analysis – Physical variable- Phase variable and Canonical variables forms- State transition matrix- Solution of second order LTI systems using state equations.

**TOTAL: 45**

**TUTORIAL : 15**

### REFERENCES:

1. M.Gopal-“Control Systems-principles and Design”-3/E -TMH, 2008.
2. I.J. Nagrath & M.Gopal , Control systems engineering” 3/E New Age Pub.-2007
3. K.Ogata - “Modern Control Engineering”- Pearson/Prentice-Hall of India Pvt Ltd-- New Delhi ,2002
4. Benjamin C- Kuo- “Automatic Control Systems” 8<sup>th</sup> edition- John wiley & Sons- 2007
5. Norman S.Nise –“Control systems Engineering 4e wiley India 2007
6. [Gene Franklin](#), [J.D. Powell](#) et al-“ Feedback Control of Dynamic Systems” 5<sup>th</sup> edition- Prentice Hall-2005

## COMPUTER NETWORKS

L	T	P	M	C
3	1	0	100	4

### UNIT I APPLICATION LAYER 9

The Network Edge- The Network Core- Delay- Loss- and Throughput in Packet-Switched Networks-Protocol Layers and Their Service Models- Networks Under Attack- -Principles of Network Applications-The Web and HTTP-File Transfer: FTP-Electronic Mail in the Internet-DNS—The Internet’s Directory Service-Peer-to-Peer Applications

### UNIT II TRANSPORT LAYER 9

Introduction and Transport-Layer Services-Multiplexing and Demultiplexing-Connectionless Transport: UDP-Principles of Reliable Data Transfer-Connection-Oriented Transport: TCP-Principles of Congestion Control-TCP Congestion Control

### UNIT III THE NETWORK LAYER 9

Introduction-Virtual Circuit and Datagram Networks- Inside a Router- The Internet Protocol (IP): Forwarding and Addressing in the Internet-Routing Algorithms Routing in the Internet-Broadcast and Multicast Routing- Mobile IP

### UNIT IV THE LINK LAYER AND LOCAL AREA NETWORKS 9

Link Layer: Introduction and Services-Error-Detection and -Correction Techniques- Multiple Access Protocols-Link-Layer Addressing-Ethernet-Link-Layers Switches- The Point-to-Point Protocol-Link Virtualization: A Network as a Link Layer- WiFi: 802-11 Wireless LANs

### UNIT V NETWORK SECURITY AND MANAGEMENT 9

Principles of Cryptography- Message Integrity- End-Point Authentication- Securing E-mail-Securing TCP Connections: SSL-Network-Layer Security: IPsec- Securing Wireless LANs-Operational Security: Firewalls and Intrusion Detection Systems-elements of QOS

**TOTAL: 45**

**TUTORIAL : 15**

### REFERENCES:

1. James .F.Kurose & W.Ross "Computer Networking: A Top down approach " - Pearson education-4 /E 2007
2. Behrouz A.Forouzan- "Data communication and Networking"- Tata McGraw-Hill-4/E- 2007.
3. Alberto Leon Garcia, Communication Networks, 2<sup>nd</sup> Edition TMH, 2004.
4. Larry L-Peterson & Peter s-Davie-"Computer Networks "-Harcourt Asia Pvt-Ltd-2/E.
5. Andrew S.Tannenbaum-"Computer Networks"- PHI/Pearson – 4/E 2003.
6. Douglas comer 'Computer networks with Internet applications" Pearson edition 2005

**COMMUNICATION SKILLS & PERSONALITY DEVELOPMENT-II**

**L T P M C**  
**0 0 3 100 1.5**

**1. DEXTERITY IN WRITING**

Importance of Writing –Writing vs Spoken Language – Formal & Informal styles of Writing – Report writing-Resources for improving Writing – Grammar and Usage – Application Essays – Project Proposals

**2. COMPOSITION ANALYSIS**

Technical and non technical passages (GRE based) - Differences in American and British English – Analyzing Contemporary issues – Expanding terminology

**3. PRESENTATION SKILLS**

Collecting and organizing materials- audience – Content – Rehearsing – Delivering matter – Questions – Seminar Presentations (Subject Oriented/ General Topics)

**4. RESUME PREPARATION**

**5. GROUP DISCUSSIONS / ACTIVITIES**

Preparation – Participation – Group Dynamics – Intra / Inter Dept-- Group Discussion – Team Work – Negotiation Skills – Organizational Behavior

**6. INTERVIEWS**

Verbal and Non verbal Skills – Rehearsing – Taking the Interview – Facing the Questions – Mock Interviews -

**7. PSYCHOMETRIC TESTS - APTITUDE TESTS AND PUZZLES**

Logical reasoning - problem solving – verbal- sharpening the skills

## DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	M	C
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### LIST OF EXPERIMENTS

#### USING TMS320C5X

- 1- Generation of Signals
- 2- Linear Convolution
- 3- Implementation of a FIR filter
- 4- Implementation of an IIR filter
- 5- Calculation of FFT

#### USING MATLAB

- 1- Generation of Discrete time Signals
- 2- Verification of Sampling Theorem
- 3- FFT and IFFT
- 4- time & Frequency response of LTI systems
- 5- Linear and Circular Convolution through FFT
- 6- Design of FIR filters (window design)
- 7-Design of IIR filters (Butterworth &Chebychev)

## NETWORKS LABORATORY

L	T	P	M	C
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1. Implementation of Error Detecting Codes(CRC)
2. Implementation of IP subnet
3. Ethernet LAN protocol
4. To create scenario and study the performance of CSMA/CD protocol simulation
5. Token bus and token ring protocols: To create scenario and study the performance of token bus and token ring protocols through simulation.
6. Wireless LAN protocols: To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
7. Implementation and study of stop and wait protocol .
8. Implementation and study of Go-back-N and selective reject protocols.
9. Implementation of distance vector routing algorithm.
- 10.Implementation of Link state routing algorithm.
- 11.Implementation of Data encryption and decryption.

**\*Open Source Software Tools like Ethereal /Wireshark Opnet IT Guru, Network Simulator 2, Router Simulator may be used for Simulation.**

## SEMESTER VI

### VLSI DESIGN

L	T	P	M	C
3	0	0	100	3

#### UNIT I MOS TECHNOLOGY

9

Chip Design Hierarchy- IC Layers –Photolithography and Pattern Transfers- Basic MOS Transistors-CMOS Fabrication – Submicron CMOS Process –Masks and Layout –CMOS Design Rules: Lambda based layout- Types of rules- SCMOS Design Rule set II-

#### UNIT II MOSFET TRANSISTOR

9

MOSFET operation - MOSFET switch model and square law model – MOSFET parasitic—MOSFET SPICE Modeling-CMOS Inverter: Voltage Transfer curve- Layout-Body Effect-Latch up problem in CMOS circuits-Latch up prevention-

#### UNIT III CMOS LOGIC GATES DESIGN AND LAYOUT

9

NAND and NOR Gates – Complex Logic Gates –Tri state circuits – Large FETs-Transmission Gate and Pass Transistor Logic-Standard Cell design: Cell hierarchy-Cell libraries-

#### UNIT IV STORAGE ELEMENTS AND DYNAMIC LOGIC CIRCUITS

9

SR Latch- Bit Level Register –D Type Flip Flop –Dynamic D Flip Flop –The Static RAM Cell – Dynamic Logic – Domino Logic – SR Logic –Dynamic Memories

#### UNIT V VHDL

9

VHDL Program Structure- concurrent code – sequential code - Variables- signals and Constants-VHDL Operators -VHDL Description of Combinational Networks: Adders – Modeling Flip Flop using VHDL Processes – VHDL Model for Multiplexer –Modeling a sequential Machine-

**TOTAL: 45**  
**TUTORIAL : 15**

#### REFERENCES

- 1- John P Uyemura- “ Chip Design for Submicron VLSI:CMOS layout and simulation” Thomson India Edition- 2006(unit I to IV)
- 2- Charles H Roth-”Digital System Design Using VHDL”- Thomson business Information India Pvt Ltd-2006 (Unit V)
- 3- Kamran Eshraghian- Douglas A Pucknell Sholeh Eshraghian “Essentials of VLSI Circuits and Systems”- Prentice Hall of India Pvt Ltd- 2006

- 4- Volnei A Pedroni-"Circuit design with VHDL"- Prentice Hall of India Pvt Ltd- 2005  
 5 Wayne Wolf," Modern VLSI Design – System On Chip", PHI 2006, 3e, New Delhi

**DIGITAL COMMUNICATION**

L	T	P	M	C
3	1	0	100	4

**UNIT I SAMPLING AND WAVEFORM CODING 9**

Sampling Theorem- Band pass sampling- PAM- PCM -Uniform and Non- Uniform  
 Quantization- Quantization error- DM and Adaptive Delta Modulation-DPCM- TDM Principles-  
 Digital Hierarchy.

**UNIT II BANDLIMITED SIGNALLING 9**

Power Spectra of PAM signals- Inter Symbol Interference- Ideal Nyquist channel- Raised  
 Cosine Channels- Correlative Coding- Eye patterns- Adaptive Equalization for Data  
 Transmission

**UNIT III PASS BAND DATA TRANSMISSION 12**

Pass band Transmission Model- ML criterion-correlation receivers- Matched filters.  
 Generation- Detection- Signal Space diagram- Bit error probability and power spectra of  
 BPSK- QPSK- FSK and MSK schemes- Performance comparisons- carrier and bit  
 synchronization

**UNIT IV ERROR CONTROL CODING 9**

Linear block codes- Cyclic codes- Convolution Codes: Coding Gain and Viterbi decoding of  
 Convolution Codes- Trellis coded modulation.

**UNIT V SPREAD SPECTRUM SYSTEMS: 6**

Pseudo Noise sequences- generation-principles of DSSS-correlation properties- m-sequence  
 and Gold sequence- FH-SS- processing gain- anti-jam

**TOTAL: 45**

**TUTORIAL: 15**

**REFERENCES:**

1. John.G.Proakis "Digital Communication"- McGraw Hill – 3/E - 2008.
2. Simon Haykins- "Digital Communications"- John Wiley, 4/E- 2007.
3. H. Taub, D.L.Schilling, G. Saha- "Principles of Communication Systems"- 3/E- Tata  
 McGraw Hill Publishing Company- New Delhi- 2008
4. K.N.Chari., D.Ganesh Rao-"Digital Communications"- 2/E- Sanguine Technical  
 Publishers- Bangalore- 2005
5. B.Sklar " Digital communications"2/E Prentice Hall-2001

## MICROCONTROLLER & RISC ARCHITECTURES

L T P M C  
3 1 0 100 4

### UNIT 1 THE 8051 ARCHITECTURE

9

8051 Microcontroller Hardware-Input/Output pins- ports and circuits-External memory-Counters and Timers-Serial Data Input/Output-Interrupts

### UNIT II THE 8051 INSTRUCTION SET AND PROGRAMMING

9

8051 Addressing Modes-Arithmetic Instructions-Logical Instructions-Single bit Instructions-Timer/Counter-Serial Communication-Interrupts Programming-Assembly Language programming

### UNIT III THE 8051-REAL WORLD INTERFACING

9

Interfacing LCD-ADC and sensors to 8051-8051 interfacing to a stepper motor-keyboard and DAC-8051 interfacing to external memory-8051 interfacing to the 8255

### UNIT IV THE ARM RISC ARCHITECTURE

9

The RISC revolution-The reduced instruction set computer –Design for low power consumption-The ARM architecture basics-Architectural inheritance-The ARM programmers model-ARM organization and implementation-3 stage and 5 stage pipeline ARM organization-ARM instruction execution-ARM implementation-ARM processor cores-ARM7 TDMI-ARM8 TDMI-ARM9 TDMI-ARM development tools-Architectural support for system development

### UNIT V ARM INSTRUCTION AND ASSEMBLY LANGUAGE PROGRAMMING

9

Exceptions-Conditional execution-Branch and branch with link and exchange-Software interrupt-Data processing instructions-Single word and unsigned byte data transfer and half word and signed byte data transfer instructions-Multiple register transfer instructions-Swap instructions-Architectural support for high level languages-The thumb instruction set-Thumb implementation-Thumb applications-Writing simple assembly language programs

**TOTAL: 45**

**TUTORIAL: 15**

### REFERENCES:

1. "Muhammad Ali Mazidi-Jamice Gillispit Mazidi-"The 8051 micro controller and Embedded System" Pearson Education,2002.
2. Ajay.V.Deshmukh, Mircro controllers Theory and applications, TMH,2004.
3. Kenneth J-Ayala-"The Microcontroller Architecture-Programming & Applications"Pearson International,2003.
4. Krishnakant "Microprocessors and Microcontrollers Architecture- programming and system design 8085- 8086- 8051- 8096"- PHI 2007- New Delhi
5. Steve Furber "ARM System-on-chip-architecture "2<sup>nd</sup> edition Addison Wesley 2000
6. Alan Clements "The Principles of Computer Hardware" 3<sup>rd</sup> edition Oxford University Press 2000

## ANTENNAS AND WAVE PROPAGATION

L T P M C

3 1 0 100 4

### UNIT I RADIATION PROPERTIES

9

Concept of vector potential- Modification for time varying- retarded case- Fields associated with Hertzian dipole- Power radiated and radiation resistance of current element-Radiation from half-wave dipole and quarter-wave monopole antennas. Radiation intensity- Directive gain- Directivity- Power gain- Beam Width- Band Width- Gain -Quarter wave monopole-Half-wave dipole and folded dipole- Reciprocity principle- Effective length and Effective area- Relation between gain effective length and radiation resistance.

### UNIT II ANTENNA ARRAYS

9

**Antenna Arrays:** Expression for electric field from two, three and N element arrays- linear arrays: Broad-side array and End-Fire array- Method of pattern multiplication- Binomial array- Horizontal and Vertical Antennas above the ground plane, Phased arrays, Frequency-Scanning arrays- Adaptive arrays and Smart antennas.

### UNIT III ANTENNA TYPES

9

Loop Antennas: Radiation from small loop and its radiation resistance- Radiation from a loop with circumference equal to a wavelength-Helical antenna: Normal mode and axial mode operation-Yagi uda Antenna- Log periodic antenna- Phased array- rhombic antenna- Horn antenna- Reflector antennas and their feed systems- Micro strip antenna-Selection of antenna based on frequency of operation – Antennas for special applications: Antenna for terrestrial mobile communication systems, GPR, Embedded antennas, UWB, Plasma antenna.

### UNIT IV WAVE PROPAGATION

9

**Ground wave propagation:** Attenuation characteristics for ground wave propagation- Calculation of field strength at a distance - **Space wave propagation:** Reflection from ground for vertically and horizontally polarized waves- Reflection characteristics of earth- Resultant of direct and reflected ray at the receiver- Duct propagation - **Sky wave propagation:** Structure of the ionosphere- Effective dielectric constant of ionized region- Mechanism of refraction- Refractive index- Critical frequency- Skip distance- Effect of earth's magnetic field- Attenuation factor for ionospheric propagation- Maximum usable frequency- Fading and Diversity reception.

### UNIT V ANTENNA AND IONOSPHERIC MEASUREMENTS

9

#### **Antenna Measurements:**

Reciprocity in Antenna measurements – Near-field and Far-field - Measurements ranges - Measurement of different Antenna parameters- Directional pattern, Gain, Phase, Polarization, Impedance, Efficiency.

**Ionosphere Measurements:**

Measurement of vertical Incidence- Group Velocity and Group Delay- Relation between oblique and vertical Incidence transmission.

**TOTAL: 45****TUTORIAL : 15****REFERENCES:**

1. John D-Kraus and Ronald Marhefka- "Antennas"- Tata McGraw-Hill Book Company- 2002-
2. E-C-Jordan and Balmain- "Electro Magnetic Waves and Radiating Systems"- PHI- 1968- Reprint 2003-
3. R-E-Collins- 'Antennas and Radio Propagation "- McGraw-Hill- 1987-
4. Ballanis "Antenna Theory " - John Wiley & Sons- second edition – 2003
5. D.Ganesh rao, B.Somanathan nair, Deepa Reghunath- "Antennas and Radio-Wave Propagation", Sanguine technical publishers, Bangalore- 2007.

## DIGITAL IMAGE PROCESSING

L	T	P	M	C
3	0	0	100	3

### UNIT I DIGITAL IMAGE FUNDAMENTALS

9

Elements of digital image processing systems- Elements of visual perception- psycho visual model- brightness- contrast- hue- saturation- mach band effect- Color image fundamentals - RGB- HSI models- Image sampling- Quantization- dither- Two-dimensional mathematical preliminaries

### UNIT II IMAGE TRANSFORMS

9

1D DFT- 2D transforms – DFT- DCT- Discrete Sine, Walsh- Hadamard- Slant- Haar Wavelet Transform

### UNIT III IMAGE ENHANCEMENT AND RESTORATION

9

Spatial domain enhancement: gray level transformations - histogram modification and specification techniques- Image averaging- Directional Smoothing- Median- Geometric mean- Harmonic mean- Contra harmonic and Yp mean filters- Homomorphic filtering- Color image enhancement. Image Restoration – degradation model- Unconstrained and Constrained restoration- Inverse filtering: Removal of blur caused by uniform linear motion- Wiener filtering- Geometric transformations: spatial transformations- Gray-Level interpolation

### UNIT IV IMAGE SEGMENTATION AND REPRESENTATION

9

Point- line and edge detection- Edge linking- Region based segmentation: Region splitting and merging.

Image representation: chain codes – polygonal approximations – signatures – boundary segments – skeletons

### UNIT V IMAGE COMPRESSION

9

Need for data compression-Error free compression: variable length coding, bit plane coding, LZW coding. Lossy compression: Transform coding, wavelet coding.

Compression standards: binary image compression standard, still image compression standards, video compression standards.

**TOTAL: 45**

**TUTORIAL : 15**

### REFERENCES:

1. Rafael C- Gonzalez- Richard E-Woods- 'Digital Image Processing'- Pearson Education- Inc-- Second Edition- 2004
2. Anil K- Jain- 'Fundamentals of Digital Image Processing'- Pearson/Prentice Hall of India- 2002-
3. David Salomon : Data Compression – The Complete Reference- Springer Verlag New York Inc-- 2<sup>nd</sup> Edition- 2001

4. William K-Pratt- 'Digital Image Processing'- John Wiley- NewYork- 2002
5. Kenneth R.Castleman-"Digital Image Processing"-Pearson-2003

**ANALOG AND DIGITAL COMMUNICATION LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>M</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>100</b>	<b>1.5</b>

1. Amplitude Modulation and demodulation-
2. Frequency Modulation and FSK Generation
3. Balanced modulator
4. Pre-emphasis & de-emphasis
5. Phase locked loop and applications
6. PWM Generation and detection
7. AM detector and AGC Characteristics
8. FM detector
9. PAM and verification of sampling theorem
10. Pulse Code Modulation Encoder and Decoder
11. Delta modulation and demodulation
12. Digital Modulation Techniques using Trainers

**I- Design and simulation of Combinational Logic Circuit using VHDL**

1. Adder
2. Multiplexer and Demultiplexer
3. Encoder and Decoder
4. Multiplier

**II- Design and simulation of Sequential logic circuit using VHDL**

5. Flip Flops
6. Counter
7. Shift registers
8. Frequency Divider

**III- CMOS Circuit design using SPICE (DC and Transient Analysis)**

9. CMOS Inverter
10. CMOS NAND and NOR Gates
11. CMOS D Latch

**IV- FPGA Implementation**

12. 4 bit Adder
13. Real Time Clock

**Equipment / Tools Required**

1. HDL Simulation Tool
2. FPGA Synthesis Tool
3. Any SPICE simulator
4. At least 500K Gate density FPGA trainer boards with adequate peripherals

**1- Assembly Language Programs using 8085/8086/8051**

- a- Programs based on Arithmetic and logic instructions-
- b- Arrays-Largest number-
- c- Sorting of an array-
- d- Code conversion
- e- Programs involving sub routines- stack-
- f- Programs with Look up table-
- g- Square root- factorial & average of n numbers-

**2- Experiments using 8051 microcontroller resources**

- a- 8051 timer:
  - keeping time and /or calculating the amount of time between events- counting events- generating baud rates for the serial port-
- b- 8051: serial communication
  - setting the serial port mode- baud rate- writing and sending to serial port
- C- 8051 port programming

**3- Experiments using the peripherals**

- a. 8255 PPI-mode 0- mode 1- mode 2-
- b. 8253 timer-to test various modes of operation and to implement a digital clock-
- c. 8251 USART-transfer data between kits at 9600 baud rate-
- d. DAC interface using 8255-
- e. ADC interface using 8255-
- f. Stepper motor interfacing using 8255-
- g. Matrix keyboard and seven segment display interface-

**4-ARM PROCESSOR**

Study of minimum system based an ARM family microcontroller and writing simple Assembly programs.

**LIST OF ELECTIVES FOR  
B.E. ELECTRONICS AND COMMUNICATION ENGG.**

**SEMESTER VI**

<b>Code No.</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>M</b>	<b>C</b>
	Medical Electronics	3	0	0	100	3
	Operating Systems	3	0	0	100	3
	Power Electronics	3	0	0	100	3
	Speech Processing	3	0	0	100	3
	Object Oriented Programming	3	0	0	100	3
	Numerical Methods and Linear Programming	3	0	0	100	3
	Network Analysis and Synthesis	3	0	0	100	3
	Neural Networks and Applications	3	0	0	100	3
	Digital Control System	3	0	0	100	3

## LIST OF ELECTIVES FOR SEMESTER VI

**MEDICAL ELECTRONICS** 3 0 0 100 3

**UNIT I RECORDING AND MONITORING INSTRUMENTS 9**

Bio electric signals and Electrodes- Biomedical Recorders-Medical display systems-monitoring systems

**UNIT II MEASUREMENT AND ANALYSIS TECHNIQUES 9**

Blood flow meters-Cardiac output measurement-Blood gas analyzers-electrophoresis-pulmonary function analyzers-

**UNIT III THERAPEUTIC EQUIPMENTS 9**

Cardiac pacemakers-cardiac defibrillators-Dialysers-Surgical diathermy-LASER-Physiotherapy and electrotherapy equipments-Oxygenations-Heart Lung Machines-

**UNIT IV MEDICAL IMAGING 9**

X-Ray and computer axial tomography-Positron Emission Tomography-MRI and NMR-Ultrasonic Imaging systems-Medical Thermograph-

**UNIT V COMPUTER APPLICATIONS IN MEDICAL FIELD 9**

Bio medical telemetry-radio pill-Tele stimulation- Latest trends in diagnosis and therapy-Physiological parameter monitoring in space station-Arrhythmia monitoring system-EEG signal analysis-Role of expert systems-Pattern recognition techniques-E-health-Application of VLSI design tools in bio electronics-

**TOTAL: 45**

### REFERENCES:

- 1- R-S-Khandpur- "Hand book of Biomedical Instrumentation-"Tata McGraw Hill- NewDelhi-1998-
- 2.Leslie Cromwel- Fred- J- Weibel- Erich-A-Pferffer- "Biomedical Instrumentation and Measurements-" Pearson/Prentice Hall India- NewDelhi-2001-  
John-C-Webster(Ed)- "Medical Instrumentation Application and Design-"3<sup>rd</sup> Edition- John Wiley&Sons Inc- New York-1998-
- 3- 4- Rangaraj-M-Rangayyan- "Biomedical Signal Analysis-A Case Study Approach-"IEEE Press- John Wiley&Sons Inc- New York-2002-
- 5- Joseph -J-Carr and John -M-Brown- "Introduction to Biomedical Equipment Technology-" John Wiley&Sons Inc- New York-2002-

## OPERATING SYSTEMS

3 0 0 100 3

### UNIT I INTRODUCTION AND TYPES OF OPERATING SYSTEMS 9

Introduction - Mainframe systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Hardware Protection - System Components – Operating System Services – System Calls – System Programs - Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication-

### UNIT II PROCESS SCHEDULING AND SYNCHRONIZATION 9

Threads – Overview – Threading issues - CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Real Time Scheduling - The Critical-Section Problem – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Critical regions – Monitors-

### UNIT III DEADLOCK 9

System Model – Deadlock Characterization – Methods for handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks - Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging-

### UNIT IV MEMORY MANAGEMENT 9

Virtual Memory – Demand Paging – Process creation – Page Replacement – Allocation of frames – Thrashing - File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection

### UNIT V FILE MANAGEMENT 9

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management- Kernel I/O Subsystems - Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management-

**TOTAL: 45**

### REFERENCES

1. Abraham Silberschatz- Peter Baer Galvin and Greg Gagne- “Operating System Concepts”- Sixth Edition- John Wiley & Sons (ASIA) Pvt- Ltd- 2003.
2. Dhamhdere, Operating System 2<sup>nd</sup> Edition, TMH,2006.
3. Harvey M- Deitel- “Operating Systems”- Second Edition- Pearson Education Pvt- Ltd- 2002-
4. Andrew S- Tanenbaum- “Modern Operating Systems”- Pearson/Prentice Hall of India Pvt- Ltd- 2003-
- 4 Davis -”operating systems “ - pearson 2005
5. William Stallings,Operating systems: Internals and design principle-5/E PHI 2004

## POWER ELECTRONICS

3 0 0 100 3

### UNIT I POWER SEMICONDUCTOR DEVICES

9

Structure- operation and characteristics of Power Semiconductor Diode- SCR-GTO- TRIAC- BJT- Power MOSFET- IGBT and MCT- Steady state and Switching characteristics- Protection

### UNIT II AC TO DC CONVERTERS

9

Half wave and full wave thyristor converters- Semi- full and dual converters-Single-phase bridge configuration-Characteristics for continuous current operation-Input power factor-Effect of source inductance-Three-phase configuration (No analysis)-DC power supply

### UNIT III AC TO AC CONVERTERS

9

Principle of on-off control- Principle of phase control-Single-phase full wave controllers with resistive and inductive loads-Three-phase full wave controllers (No analysis)-Single-phase cyclo-converter-Static circuit breakers

### UNIT IV DC TO DC CONVERTERS

9

DC to DC converters using devices other than thyristors-Principle of step down and step up operation-Converter classification-Switching mode regulators-Buck- Boost and Buck-Boost regulators-DC power supply

### UNIT V DC TO AC CONVERTERS

9

DC to AC converters using devices other than thyristors-Single-phase and Three-phase inverters-Voltage Control-Single pulse-width- Multiple pulse-width and sinusoidal pulse-width modulation-Harmonic reduction- Current Source inverters-Uninterrupted Power Supply

**TOTAL: 45**  
**TUTORIAL : 15**

### REFERENCES:

1. M.D.Singh, Power Electronics, 2<sup>nd</sup> Edition, TMH2007.  
Muhamad H- Rashid- "Power Electronics: Circuits- Devices and Applications Pearson/Prentice-Hall of India - Delhi- Third Edition- 2007-
2. Ned Mohan- Tore-M-Undeland- William-P-Robbins- "Power Electronics: Converters- Applications and Design"- John Wiley and Sons- Third Edition- 2003-
3. M S Jamil Asghar- "Power Electronics" Prentice Hall of India- New Delhi- 2007
4. Mr- V Jaganathan- "Introduction to Power Electronics"- Prentice Hall of India- New Delhi- 2006-
5. RS Ananda Murthy- V- Nattarasu- "Power Electronics"- Sanguine Technical Publishers- Bangalore- 2005

## **SPEECH PROCESSING**

3 0 0 100 3

### **UNIT I ANALYTICAL BACKGROUND AND TECHNIQUES**

**9**

Analysis of Discrete – Time speech signals – Time frequency analysis of speech- Analysis based on Linear predictive loading- Cepstral Analysis of Speech- Automatic Extraction and Tracking of Speech Formants- Automatic extraction of voicing pitch- Auditory Model for speech Analysis-

Linear Model and Dynamic System Model-Linear Model- Time-Varying Linear Model- Linear Dynamic System Model- Time-Varying Linear Dynamic Systems Model- Nonlinear Dynamic System Model

### **UNIT II FUNDAMENTALS OF SPEECH SCIENCE**

**9**

Phonetic Process – Introduction- Articulatory Phonetics and Speech generation- Acoustic Models of Speech Production- Coarticulation- Acoustic – Phonetics and characterization of speech signals- Introduction to Auditory Phonetics- Sound Perception- Speech Perception Phonological process – phonemes- Features- Articulatory Phonology

### **UNIT III MODELS FOR AUDITORY SPEECH PROCESSING**

**9**

Models for the Cochlear function- Frequency Domain Solution of the Cochlear Model- Time Domain Solution of the Cochlear Model- Stability Analysis for Time Domain Solution of the Cochlear Model- Models for inner hair cells and for synapses to Auditory nerve fibres- Interval based speech feature extraction from the cochlear model outputs- Interval-Histogram representation for the speech sound in Quiet in noise- models for network structures in the auditory pathway.

### **UNIT IV SPEECH CODING**

**9**

Introduction- Statistical Models- Scalar Quantization- Vector Quantization (VQ)- Frequency-Domain Coding- Model-Based Coding- LPC Residual Coding

### **UNIT V SPEECH TECHNOLOGY IN SELECTED AREAS**

**9**

Speech Recognition – Introduction- Mathematical formulation- Acoustic Pre-processor- Use of HMMs in Acoustic Modelling- Use of higher order statistical models in acoustic modelling- case study – speech recognition using a Hidden Markov Model - Robustness of Acoustic Modelling and Recognizer Design- Speed synthesis – Introduction- Basic approaches- Synthesis Methods- Databases- Case Study – Automatic unit selection for waveform speech synthesis

**TOTAL: 45**

**TUTORIAL : 15**

**REFERENCES:**

1. Li Deng Douglas O'Shaughnessy- "Speech Processing: A Dynamic and Optimization oriented Approach"- Signal Processing and Communication Series- Printed in USA- 2003
2. Thomas F-Quatieri- "Discrete Time Speech Signal Processing: Principles and Practice"- Pearson Education- New Delhi- 2006
3. Rabiner and Schaffer Pearson
4. [John R., Jr. Deller](#) , Discrete-Time Processing of Speech Signals , Wiley-IEEE Press-1999
5. [Quatieri](#), Discrete-Time Speech Signal Processing: Principles and Practice, PHI-2006

## **OBJECT ORIENTED PROGRAMMING**

3 0 0 100 3

### **UNIT I OBJECT ORIENTED PROGRAMMING AND BASICS OF C++ 9**

Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Object-oriented languages – Applications of OOP – C++ statements – Structure of C++ Program-

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators – Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading-

### **UNIT II CLASSES AND OBJECTS 9**

Specifying a class – Defining member functions – Private member functions – Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments – Friendly functions – Returning objects- Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors – Destructors-

### **UNIT III STATIC AND DYNAMIC POLYMORPHISM 9**

Defining operator overloading: Overloading unary- binary operators - Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions-

### **UNIT IV INTRODUCTION TO JAVA 9**

Java features: How Java differs from C and C++ - Simple Java program – Java program structures – Java tokens – Java statements – Implementing a Java program – Java virtual machine – Command line arguments - Constants – Variables – Data types – Scope of variables – Operators in Java-

Defining a class – Adding variables and methods – Creating objects – Accessing class members – Constructors – Method overloading – Static members – Inheritance: Extending a class – Overriding methods – Final variables and methods – Final classes – Abstract methods and classes – Visibility control - Arrays – One dimensional array – Creating an array – Two-dimensional arrays – Strings – Vectors-

Defining interfaces – Extending interfaces – Implementing interfaces – Accessing interface variables – Java API packages – Using system packages – Creating- accessing and using a package – Adding a class to a package - Creating threads – Extending the thread class – Stopping and blocking a thread – Thread exceptions – Thread priority – Synchronization – Life cycle of a thread – Using thread methods-

Types of errors: Exceptions – Syntax of exception handling code – Multiple catch statements – Using finally statements – Throwing our own exceptions – Using exceptions for debugging- Preparing to write applets – Applet lifecycle – Creating an executable applet – Designing a web page – Applet tag – Adding applet to HTML file – Running the Applet-

**TOTAL: 45**

**TUTORIAL : 15**

**REFERENCES:**

1. E-Balagurusamy- 'Object Oriented Programming with C++'- Second edition- Tata McGraw Hill- 2003
2. E-Balagurusamy- 'Programming with JAVA – A Primer'- Second edition- Tata McGraw Hill- 2003
3. Herbert Schildt- 'C++ - The Complete Reference'- Tata McGraw Hill- 1997
4. Kris Jasma- 'Java Programming – A Complete Reference'- Galgotia Publication- 1994
5. Gotfried “ Object oriented programming with c++” Schaum’s series-TMH-2007
6. kamthane “ object oriented programming with ANSI And turbo C++,Pearson-2007
7. Stroustrup “ the c++ programming language” pearson 2005

## Numerical Methods and Linear Programming

3 0 0 100 3

### **UNIT I: Curve Fitting and Theory of Equations:** 9

Empirical laws and curve fitting- linear law- method of group averages- principle of Least squares- fitting straight line, parabola, exponential curve- method of moments- theory of equations- Relation between the roots and coefficients of polynomial equation- equations with real coefficients and imaginary roots- equations with rational coefficients and irrational roots- symmetric of roots- Transformation of equations- Reciprocal equations.

### **UNIT II: Solution of Equations:** 9

Solution of numerical algebraic and transcendental equations- the Bisection method- Iteration method- RegulaFalsi method- Newton Raphson method- Horner's method- Solution of Simultaneous Linear algebraic equations- Gauss Elimination method- Gauss Jordan method- Crout's method- Gauss Jacobi method- Gauss Seidel method- Relaxation method.

### **UNIT III: Difference Calculus:** 9

Finite differences- Forward, Backward and central difference operator- shifting operator- Properties and relation between operators- Interpolation- Newton's forward and Backward difference interpolation formula- Gauss forward and backward difference interpolation formula- Bessel's Laplace and Everett formula.

### **UNIT IV: Interpolation, Numerical differentiation and Integration:** 9

Interpolation with unequal intervals- Divided differences- Newton's divided Difference formula- Lagrange's interpolation formula-inverse interpolation- Numerical Differentiation- Newton's forward and backward differentiation formula- Numerical Integration- The trapezoidal rule- Simpson's  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rule-Difference equations- solution of linear homogeneous difference equation with constant coefficients.

### **UNIT V: Numerical Solution of Differential equation:** 9

Numerical solutions of ordinary differential equations- Taylor series method- Picards method- Euler's Method- Fourth order Runge Kutta method- Milne's and Adam's predictor- Corrector methods- Numerical solution of elliptic equation by Leibmann's method- solution of parabolic equation by Bender – Schmidt method- Solution of hyperbolic equation.

**Mat lab : Toolkits – the course content will be augmented by the usage of Mat lab tool box.**

**References:**

1. Curtis.F.Gerald, Patrick.O Wheatly, Applied Numerical Analysis, 6<sup>th</sup> Edition, Pearson Education New Delhi 2002.
2. John Mathews, Kurtis.D. Fink, Numerical Methods using MATLAB, PHI 1998.
3. Kandasamy.P , Thilagavathy.K and Gunavathy.k, Numerical methods, S.Chand and company Ltd., New Delhi, 2003.
4. Jain.M.k. Iyengar, S.R.K.Jain, Jain.R.K, Numerical Methods for Scientific and Engineering Computation, 4<sup>th</sup> Edition New age International Publishers, New delhi, 2003.
5. Sastry.S.S, Introductory Methods of Numerical analysis, PHI , 2001.

**NETWORK ANALYSIS AND SYNTHESIS**      3   0   0   100   3

**UNIT I**      **9**

Network concept- Elements and sources- Network equilibrium equations- Node and mesh method-Network theorems –Tellegen’s Theorem

**UNIT II**      **9**

First and second order networks- State space equations- Transient response- Network functions- driving point and transfer functions- natural frequencies

**UNIT III**      **9**

Sinusoidal steady-state analysis- Maximum power-transfer theorem- Resonance- Equivalent and dual networks- Design of equalizers-

**UNIT IV**      **9**

Two-port network parameters-Z,Y,h ,ABCD parameters- Barlett’s bisection theorem-lattice network-Image and iterative parameters- Design of attenuators-

**UNIT V**      **9**

Two-terminal network synthesis- Reactance networks- Foster’s reactance theorem- Synthesis of RL and RC networks-Cauer and Foster synthesis

**TOTAL: 45**

**TUTORIAL : 15**

**REFERENCES:**

1. W-H-Hayt & J-E-Kemmerly-“ Engineering Circuit Analysis”-6 e 2006- Tata McGraw-Hill.
2. T-S-Huang & R-R-Parker- “Network Theory- Addison”-Wesley- 1971.
3. Van Valkenburg : “Network Analysis”.pearson 2005
4. Van Valkenburg :”Network Syntethesis”.
5. F.F.Kuo Network analysis and synthesis 2/E John Wiley

### Unit I Neuron model network architecture

Neuron model – single input neuron –activation function – multiple input neuron neural networks viewed as directed graphs -feedback - network architectures – knowledge representation – linear and non- linear separable problem(XOR)

### Unit II Learning process

Error – correction learning – memory based learning - hebbian learning-competitive learning-Boltzmann learning-credit assignment problem-supervised and unsupervised learning-adaptation-statistical learning theory.

### Unit III Perceptions

Single layer perception-Adaptive filtering-unconstrained optimization-Least-mean square algorithm-Leaning curve-Annealing Technique-perception convergence theorem-Relationship between perception and Baye's classifier-Back propagation algorithm- Network pruning techniques-supervised learning viewed as an optimization problem-convolutional network. Application to Adaptive Prediction and character recognition.

### Unit IV Attractor neural Network and ART

Hopfield model-BAM model-BAM stability-Adaptive BAM -Lyapunov function-effect of gain-Hopfield design-Application to TSP problem-ART- layer 1-layer 2-orienting subsystem-Leaning lawL1-L2-Leaning law L2-L1-ART algorithm-ARTMAP

### Unit V Principal Component Analysis and Self Organization

Principle of self organization-Principle Component analysis-Adaptive PCA using Lateral inhibition-Two classes of PCA algorithm-Two basic feature- mapping model-self organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical vector Quantization. Applications of self-organizing maps: The Neural Phonetic Typewriter-Learning Ballistic Arm Movements

### REFERENCES

1. Simon Haykin, "Neural Networks and Learning Machines" -3/E - Pearson/ Prentice Hall 2009
2. Satish Kumar- "Neural Networks : A Classroom Approach"-TMH-2008
3. Freeman J.A., Skapura D.M."Neural networks, algorithms, applications, and programming techniques" -Addition Wesley, 2005.
4. [Laurene Fausett](#),"Fundamentals of Neural Networks: Architectures, Algorithms, and Applications" - Pearson/ Prentice Hall
5. Robert J Schalkoff-"Artificial Neural Networks,McGraw Hill"-1997

**1. INTRODUCTION****10**

Overview of frequency and time response analysis and specifications of control systems - Advantages of digital control systems – basic concepts of sampled data control systems – principle of sampling, quantization and coding – Reconstruction of signals – Sample and Hold circuits – Practical aspects of choice of sampling rate -Basic discrete time signals – Time domain models for discrete time systems.

**2. Z TRANSFORMATION****9**

Z-transform, Z-transfer function – Inverse Z transform, Z-transform analysis of sampled data control system, Z and S domain Relationship

**3. TRANSFER FUNCTIONS AND SIGNAL FLOW GRAPHS****8**

Pulse Transfer function and z transfer function – Closed loop systems – modified z transfer function – sampled signal flow graph – Multirate Discrete data systems.

**4. STATE VARIABLE ANALYSIS****9**

State space representation of discrete time systems – state equations of discrete data system with sample and Hold devices – State transition matrix – State diagram of digital systems – Decomposition of discrete data transfer systems.

**5. STABILITY ANALYSIS****9**

Mapping between S plane and Z plane- Jury's stability test - Bilinear transformation and extended Routh array- Root Locus Method

**THEORY:45; TUTORIAL:15; TOTAL:60****REFERENCES:**

1. Gopal M. ' Digital Control and State Variable methods', Tata Mc Graw Hill Publishing Company Ltd., New Delhi, India, 2003.
2. Kuo B.C. ' Digital Control Systems', Oxford University Press, Inc., 2003
3. Ogata K. 'Discrete Time Control Systems', Prentice Hall International, New Gercy, USA, 2002.
4. Houpis C.H. and Lamont C.B., 'Digital Control Systems', Tata Mc Graw Hill, 1999.
5. I.J.Nagarth and M.Gopal - Control systems engineering - Wiley Eastern Ltd., 1993