SCHEME OF TEACHING AND EXAMINATION

B.E., ELECTRONICS AND COMMUNICATION

V SEMESTER **COMMON TO EC / TE**

Sl. No	Sub-Code	Title	Teaching Dept.	Teaching hours /week		Examination			
				Theory	Pract.	Duration	I.A. Marks	Theory/ Pract.	Total Marks
1	06AL51	Management & Entrepreneurship	EC	04	---	03	25	100	125
2	06EC52	Digital signal Processing	EC	04	---	03	25	100	125
3	06EC53	Analog Communication	EC	04	---	03	25	100	125
4	06EC54	Microwaves and Radar	EC	04	---	03	25	100	125
5	06EC55	Digital Switching Systems	EC	04	---	03	25	100	125
6	06EC56	Fundamentals of CMOS VLSI	EC	04	---	03	25	100	125
7	06ECL57	DSP Lab	EC	--	03	03	25	50	75
8	06ECL58	Analog Communication Lab + LIC Lab	EC	--	03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

VI SEMESTER **B.E., ELECTRONICS AND COMMUNICATION**

Sl. No	Sub-Code	Title	Teaching Dept.	Teaching hours /week		Examination			
				Theory	Pract.	Duration	I.A. Marks	Theory/ Pract.	Total Marks
1	06EC61	Digital Communication	EC	04	---	03	25	100	125
2	06EC62	Microprocessors	EC	04	---	03	25	100	125
3	06EC63	Analog and Mixed mode VLSI Design	EC	04	---	03	25	100	125
4	06EC64	Antennas and Propagation	EC	04	---	03	25	100	125
5	06EC65	Information theory and coding	EC	04	---	03	25	100	125
6	06EC66x	Elective- 1(Group-A)	EC	04	---	03	25	100	125
7	06ECL67	Advanced Communication Lab	EC	--	03	03	25	50	75
8	06ECL68	Microprocessors Lab	EC	--	03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

ELECTIVE -1(Group A)

06EC661	Programming in C ++	06EC664	Adaptive Signal Processing
06EC662	Satellite Communications	06EC665	Low Power VLSI Design
06EC663	Random Processes	06EC666	Modern Control theory
		06EC667	Digital System Design Using VHDL

SCHEME OF TEACHING AND EXAMINATION

B.E., ELECTRONICS AND COMMUNICATION

VII SEMESTER

Sl. No	Sub-Code	Title	Teaching Dept.	Teaching hours /week		Examination			
				Theory	Pract.	Duration	I.A. Marks	Theory/ Pract.	Total Marks
1	06EC71	Computer Communication Network	EC	04	---	03	25	100	125
2	06EC72	Optical Fiber Communication	EC	04	---	03	25	100	125
3	06EC73	Power Electronics	EC	04	---	03	25	100	125
4	06EC74	DSP Algorithms & Architecture	EC	04	---	03	25	100	125
5	06EC75x	Elective-2 (Group B)	EC	04	---	03	25	100	125
6	06EC76x	Elective-3 (Group C)	EC	04	---	03	25	100	125
7	06ECL77	VLSI Lab	EC	--	03	03	25	50	75
8	06ECL78	Power Electronics Lab		--	03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

ELECTIVE -2 (Group B)

06EC751	Operating Systems
06EC752	Pattern Recognition
06EC753	Artificial Neural Network
06EC754	CAD For VLSI
06EC755	ATM Networks
06EC756	Image Processing
06EC757	Applied Embedded System Design
06EC758	Video Engineering

ELECTIVE -3 (Group C)

06EC761	Data Structures using C++
06EC762	Real Time Systems
06EC763	Radio Frequency Integrated Circuits
06EC764	Wavelet Transforms
06EC765	Modeling & Simulation of Data Networks
06EC766	Speech Processing
06EC767	H R Management
06EC769	Micro and Smart Systems Technology

SCHEME OF TEACHING AND EXAMINATION

B.E., ELECTRONICS AND COMMUNICATION

VIII SEMESTER

Sl. No	Sub-Code	Title	Teaching Dept.	Teaching hours /week		Examination			
				Theory	Pract. /Project	Duration	I.A. Marks	Theory/ Pract.	Total Marks
1	06EC81	Wireless Communication	EC	04	---	03	25	100	125
2	06EC82	Embedded System Design	EC	04	---	03	25	100	125
3	06EC83x	Elective -4 (Group D)	EC	04	---	03	25	100	125
4	06EC84x	Elective- 5 (Group E)	EC	04	---	03	25	100	125
5	06EC85	Project Work	EC	--	06	03	100	100	200
6	06EC86	Seminar	EC	---	03	---	50	--	50
TOTAL				**16**	**09**	**15**	**250**	**500**	**750**

ELECTIVE -4 (Group D)

06EC831	Distributed Systems
06EC832	Network Security
06EC833	Internet Engineering
06EC834	Biomedical Signal Processing
06EC835	High performance computer networks
06EC836	Fuzzy Logic

ELECTIVE -5 (Group E)

06EC841	Multimedia Communication
06EC842	Real Time Operating Systems
06EC843	Optical Networks
06EC844	GSM
06EC845	Adhoc Wireless Networks
06EC846	Optical Computing

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	: **06AL51**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and functional areas of Management - Management as a Science, Art or Profession Management & Administration - Roles of Management, Levels of Management, Development of Management Thought-Early Management Approaches-Modern Management Approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANISING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees – Centralisation Vs Decentralisation of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing - Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance – Coordination, meaning and importance and Techniques of Co - ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control.

7 Hours

PART - B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an

emerging Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

6 Hours

UNIT - 6

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI - Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I., Effect of WTO/GATT Supporting Agencies of Government for S.S.I Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

6 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities - Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management** - P. C. Tripathi, P. N. Reddy; Tata McGraw Hill.
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House.
3. **Entrepreneurship Development** - Small Business Enterprises - Poornima M Charantimath - Pearson Education – 2006.

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development Robert Lusier – Thomson.
2. **Entrepreneurship Development** - S S Khanka - S Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education /PHI -17th Edition, 2003.

DIGITAL SIGNAL PROCESSING

Subject Code	: **06EC52**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.

7 Hours

UNIT - 2

Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method.

6 Hours

UNIT - 3

Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).

8 Hours

UNIT - 4

Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform

6 Hours

PART - B

UNIT - 5

IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebysheve filters, analog to analog frequency transformations.

6 Hours

UNIT - 6

FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlet and Kaiser windows, FIR filter design using frequency sampling technique

6 Hours

UNIT - 7

Design of IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms, Verification for stability and linearity during mapping

7 Hours

UNIT - 8

Implementation of discrete-time systems: Structures for IIR and FIR systems-direct form I and direct form II systems, cascade, lattice and parallel realization.

6 Hours

TEXT BOOK:

1. **Digital signal processing – Principles Algorithms & Applications**, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

REFERENCE BOOKS:

1. **Discrete Time Signal Processing**, Oppenheim & Schaffer, PHI, 2003.
2. **Digital Signal Processing**, S. K. Mitra, Tata Mc-Graw Hill, 2nd Edition, 2004.
3. **Digital Signal Processing**, Lee Tan: Elsivier publications, 2007

ANALOG COMMUNICATION

Subject Code	: **06EC53**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

RANDOM PROCESS: Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, cross – correlation functions. Central limit theorem, Properties of Gaussian process.

7 Hours

UNIT - 2

AMPLITUDE MODULATION: Introduction, AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.

7 Hours

UNIT - 3

SINGLE SIDE-BAND MODULATION (SSB): Quadrature carrier multiplexing, Hilbert transform, properties of Hilbert transform, Pre-

envelope, Canonical representation of band pass signals, Single side-band modulation, Frequency-Domain description of SSB wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves.

6 Hours

UNIT - 4

VESTIGIAL SIDE-BAND MODULATION (VSB): Frequency – Domain description, Generation of VSB modulated wave, Time - Domain description, Envelop detection of VSB wave plus carrier, Comparison of amplitude modulation techniques, Frequency translation, Frequency division multiplexing, Application: Radio broadcasting, AM radio.

6 Hours

PART - B

UNIT - 5

ANGLE MODULATION (FM)-I: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM.

6 Hours

UNIT - 6

ANGLE MODULATION (FM)-II: Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Nonlinear effects in FM systems.

6 Hours

UNIT - 7

NOISE: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise temperature, cascade connection of two-port networks.

6 Hours

UNIT - 8

NOISE IN CONTINUOUS WAVE MODULATION SYSTEMS: Introduction, Receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM,.

8 Hours

TEXT BOOKS:

1. **Communication Systems**, Simon Haykins, 3rd Edition, John Willey, 1996.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley, 2003.

REFERENCE BOOKS:

1. **Modern digital and analog Communication systems** B. P. Lathi, 3rd ed 2005 Oxford University press.

2. **Communication Systems**, Harold P.E, Stern Samy and A Mahmond, Pearson Edn, 2004.
3. **Communication Systems**: Singh and Sapre**:** Analog and digital TMH 2nd , Ed 2007.

MICROWAVES AND RADAR

Subject Code	: **06EC54**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

MICROWAVE TRANSMISSION LINES: Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance. Smith chart, impedance matching using single stubs, Microwave coaxial connectors.

7 Hours

UNIT - 2

MICROWAVE WAVEGUIDES AND COMPONENTS: Introduction, rectangular waveguides, circular waveguides, microwave cavities, microwave hybrid circuits, directional couplers, circulators and isolators.

7 Hours

UNIT - 3

MICROWAVE DIODES,

Transfer electron devices: Introduction, GUNN effect diodes – GaAs diode, RWH theory, Modes of operation, Avalanche transit time devices: READ diode, IMPATT diode, BARITT diode, Parametric amplifiers
Other diodes: PIN diodes, Schottky barrier diodes.

7 Hours

UNIT - 4

Microwave network theory and passive devices. Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi port networks.

6 Hours

PART - B

UNIT - 5

Microwave passive devices, Coaxial connectors and adapters, Phase shifters, Attenuators, Waveguide Tees, Magic tees.

4 Hours

UNIT - 6

STRIP LINES: Introduction, Microstrip lines, Parallèle strip lines, Coplanar strip lines, Shielded strip Lines.

6 Hours

UNIT - 7

AN INTRODUCTION TO RADAR: Basic Radar, The simple form of the Radar equation, Radar block diagram, Radar frequencies, application of Radar, the origins of Radar.

8 Hours

UNIT - 8

MTI AND PULSE DOPPLER RADAR: Introduction to Doppler and MTI Radar, delay line Cancellers, digital MTI processing, Moving target detector, pulse Doppler Radar.

7 Hours

TEXT BOOKS:

1. **Microwave Devices and circuits**- Liao / Pearson Education.
2. **Introduction to Radar systems**-Merrill I Skolnik, 3rd Ed, TMH, 2001.
3. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2001.

REFERENCE BOOK:

1. **Microwave Engineering** – David M Pozar, John Wiley, 2e, 2004.

DIGITAL SWITCHING SYSTEMS

Subject Code	: **06EC55**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM, PDH and SDH, Transmission performance.

8 Hours

UNIT - 2

EVOLUTION OF SWITCHING SYSTEMS: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.

4 Hours

DIGITAL SWITCHING SYSTEMS: Fundamentals : Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program

control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing.

4 Hours

UNIT - 3

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

6 Hours

UNIT - 4

SWITCHING SYSTEMS: Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems.

6 Hours

PART - B

UNIT - 5

TIME DIVISION SWITCHING: Introduction, space and time switching, Time switching networks, Synchronisation.

4 Hours

UNIT - 6

SWITCHING SYSTEM SOFTWARE: Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Digital switching system software classification, Call models, Connect sequence, Software linkages during call, Call features, Feature flow diagram, Feature interaction.

6 Hours

UNIT - 7

MAINTENANCE OF DIGITAL SWITCHING SYSTEM: Introduction, Scope, Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability, Embedded patcher concept, Growth of digital switching system central office, Generic program upgrade, A methodology for proper maintenance of digital switching system, Effect of firmware deployment on digital switching system, Firmware-software coupling, Switching system maintainability metrics, Upgrade process success rate, Number of patches applied per year, Diagnostic resolution rate, Reported critical and major faults corrected, A strategy improving software quality, Program for software process improvement, Software processes improvement, Software processes, Metrics, Defect analysis, Defect analysis.

8 Hours

UNIT - 8

A GENERIC DIGITAL SWITCHING SYSTEM MODEL: Introduction, Scope, Hardware architecture, Software architecture, Recovery strategy,

Simple call through a digital system, Common characteristics of digital switching systems. Analysis report. Reliability analysis.

6 Hours

TEXT BOOKS:

1. **Telecommunication and Switching, Traffic and Networks** - J E Flood**:** Pearson Education, 2002.
2. **Digital Switching Systems**, Syed R. Ali, TMH Ed 2002.

REFERENCE BOOK:

1. **Digital Telephony** - John C Bellamy: Wiley India 3rd Ed, 2000.

FUNDAMENTALS OF CMOS VLSI

Subject Code	: **06EC56**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

BASIC MOS TECHNOLOGY: Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. Production of E-beam masks.

4 Hours

MOS TRANSISTOR THEORY: Introduction, MOS Device Design Equations, The Complementary CMOS Inverter – DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter.

4 Hours

UNIT - 2

CIRCUIT DESIGN PROCESSES: MOS layers. Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams. Tutorial exercises.

4 Hours

Basic Physical Design of Simple logic gates. **3 Hours**

UNIT - 3

CMOS LOGIC STRUCTURES: CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic (CVSL).

6 Hours

UNIT - 4

BASIC CIRCUIT CONCEPTS: Sheet resistance. Area capacitances. Capacitance calculations. The delay unit. Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.

4 Hours

SCALING OF MOS CIRCUITS: Scaling models and factors. Limits on scaling. Limits due to current density and noise.

3 Hours

UNIT - 5

CMOS SUBSYSTEM DESIGN: Architectural issues. Switch logic. Gate logic. Design examples – combinational logic. Clocked circuits. Other system considerations. **4 Hours**

Clocking Strategies **4 Hours**

UNIT - 6

CMOS SUBSYSTEM DESIGN PROCESSES: General considerations. Process illustration. ALU subsystem. Adders. Multipliers.

6 Hours

UNIT - 7

MEMORY, REGISTERS AND CLOCK: Timing considerations. Memory elements. Memory cell arrays.

5 Hours

UNIT - 8

TESTABILITY: Performance parameters. Layout issues. I/O pads. Real estate. System delays. Ground rules for design. Test and testability.

5 Hours

TEXT BOOKS:

1. **Basic VLSI Design** - Douglas A. Pucknell & Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994), 2005.
2. **Principles of CMOS VLSI Design: A Systems Perspective**, Neil H. E. Weste and K. Eshragian, 2nd edition, Pearson Education (Asia) Pvt. Ltd., 2000.

REFERENCE BOOKS:

1. **Fundamentals of Semiconductor Devices**, M. K. Achuthan and K. N. Bhat, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
2. **CMOS Digital Integrated Circuits: Analysis and Design**, Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
3. **Analysis and Design of Digital Integrated Circuits** - D.A Hodges, H.G Jackson and R.A Saleh. 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

DIGITAL SIGNAL PROCESSING LABORATORY

Subject Code	: **06ECL57**	IA Marks	: 25
No. of Practical Hrs/Week: 03		Exam Hours	: 03
Total no. of Practical Hrs. : 42		Exam Marks	: 50

A LIST OF EXPERIMENTS USING MATLAB / SCILAB / OCTAVE / WAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.

B. LIST OF EXPERIMENTS USING DSP PROCESSOR

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications .The input can be a signal from function generator / speech signal.
5. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms
6. Noise: Add noise above 3kHz and then remove; Interference suppression using 400 Hz tone.
7. Impulse response of first order and second order system

REFERENCE BOOKS:

1. **Digital signal processing using MATLAB -** Sanjeet Mitra, TMH, 2001
2. **Digital signal processing using MATLAB** - J. G. Proakis & Ingale, MGH, 2000
3. **Digital Signal Processors**, B. Venkataramani and Bhaskar, TMH,2002

ANALOG COMMUNICATION LAB + LIC LAB

Subject Code	: **06ECL58**	IA Marks	: 25
No. of Practical Hrs/Week	: 03	Exam Hours	: 03
Total no. of Practical Hrs.	: 42	Exam Marks	: 50

EXPERIMENTS

1. Second order active LPF and HPF
2. Second order active BPF and BE
3. Schmitt Trigger Design and test a Schmitt trigger circuit for the given values of UTP and LTP
4. Frequency synthesis using PLL.
5. Design and test R-2R DAC using op-amp
6. Design and test the following circuits using IC 555
    a. Astable multivibrator for given frequency and duty cycle
    b. Monostable multivibrator for given pulse width W
7. Class C Single tuned amplifier
8. Amplitude modulation using transistor/FET (Generation and detection)
9. Pulse amplitude modulation and detection
10. PWM and PPM
11. Frequency modulation using 8038/2206
12. Precision rectifiers – both Full Wave and Half Wave.

VI SEMESTER

DIGITAL COMMUNICATION

Subject Code	: **06EC61**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Basic signal processing operations in digital communication. Sampling Principles: Sampling Theorem, Quadrature sampling of Band pass signal, Practical aspects of sampling and signal recovery.

7 Hours

UNIT - 2

PAM, TDM. Waveform Coding Techniques, PCM, Quantization noise and SNR, robust quantization.

7 Hours

UNIT - 3

DPCM, DM, applications. Base-Band Shaping for Data Transmission, Discrete PAM signals, power spectra of discrete PAM signals.

6 Hours

UNIT - 4

ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.

6 Hours

PART - B

UNIT - 5

DIGITAL MODULATION TECHNIQUES: Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques. Non-coherent binary modulation techniques.

7 Hours

UNIT - 6

Detection and estimation, Model of DCS, Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input.

6 Hours

UNIT - 7

Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.

6 Hours

UNIT - 8

Spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum, coherent binary PSK, frequency

hop spread spectrum, applications.

7 Hours

TEXT BOOK:

1. **Digital communications**, Simon Haykin, John Wiley, 2003.

REFERENCE BOOKS:

1. **Digital and analog communication systems & An introduction to Analog and Digital Communication**, K. Sam Shanmugam, John Wiley, 1996. 2.Simon Haykin, John Wiley, 2003
2. **Digital communications** - Bernard Sklar: Pearson education 2007

MICROPROCESSOR

Subject Code	: **06EC62**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

8086 PROCESSORS: Historical background, The microprocessor-based personal computer system, 8086 CPU Architecture, Machine language instructions, Instruction execution timing, The 8086

7 Hours

UNIT - 2

INSTRUCTION SET OF 8086: Assembler instruction format, data transfer and arithmetic, branch type, loop, NOP & HALT, flag manipulation, logical and shift and rotate instructions. Illustration of these instructions with example programs, Directives and operators

7 Hours

UNIT - 3

BYTE AND STRING MANIPULATION: String instructions, REP Prefix, Table translation, Number format conversions, Procedures, Macros, Programming using keyboard and video display

6 Hours

UNIT - 4

8086 INTERRUPTS: 8086 Interrupts and interrupt responses, Hardware interrupt applications, Software interrupt applications, Interrupt examples

6 Hours

PART - B

UNIT - 5

8086 INTERFACING: Interfacing microprocessor to keyboard (keyboard types, keyboard circuit connections and interfacing, software keyboard interfacing, keyboard interfacing with hardware), Interfacing to alphanumeric

displays (interfacing LED displays to microcomputer), Interfacing a microcomputer to a stepper motor

6 Hours

UNIT - 6

8086 BASED MULTIPROCESSING SYSTEMS: Coprocessor configurations, The 8087 numeric data processor: data types, processor architecture, instruction set and examples

6 Hours

UNIT - 7

SYSTEM BUS STRUCTURE: Basic 8086 configurations: minimum mode, maximum mode, Bus Interface: peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), the universal serial bus (USB)

7 Hours

UNIT - 8

80386, 80486 AND PENTIUM PROCESSORS: Introduction to the 80386 microprocessor, Special 80386 registers, Introduction to the 80486 microprocessor, Introduction to the Pentium microprocessor.

7 Hours

TEXT BOOKS:

1. **Microcomputer systems-The 8086 / 8088** Family – Y.C. Liu and G. A. Gibson, 2E PHI -2003
2. **The Intel Microprocessor, Architecture, Programming and Interfacing**-Barry B. Brey, 6e, Pearson Education / PHI, 2003

REFERENCE BOOKS:

1. **Microprocessor and Interfacing- Programming & Hardware**, Douglas hall, 2e TMH, 1991
2. **Advanced Microprocessors and Peripherals** - A.K. Ray and K.M. Bhurchandi, TMH, 2001
3. **8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware & Applications** - Triebel and Avtar Singh, 4e, Pearson Education, 2003

ANALOG AND MIXED MODE VLSI DESIGN

Subject Code	: **06EC63**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART – A

(Text Book 1)

UNIT 1

Data converter fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

06Hours

UNIT 2

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

14Hours

UNIT 3

Non-Linear Analog Circuits: Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Stimulation), Level Shifting (Excluding Input Level Shifting For Multiplier).

06Hours

PART B

(Text Book 2)

UNIT 4:

Data Converter SNR: Improving SNR Using Averaging (Excluding Jitter & Averaging onwards), Decimating Filters for ADCs (Excluding Decimating without Averaging onwards), Interpolating Filters for DAC, B and pass and High pass Sync filters.

06Hours

UNIT 5

Su-Microns CMOS circuit design: Process Flow, Capacitors and Resistors, MOSFET Switch (upto Bidirectional Switches), Delay and adder Elements, Analog Circuits MOSFET Biasing (upto MOSFET Transition Frequency).

14Hours

UNIT 6

OPAmp Design (Excluding Circuits Noise onwards)

06Hours

TEXT BOOK:

1. **Design, Layout, Stimulation ,**R. Jacaob Baker, Harry W Li, David E Boyce, CMOS Circuit, PHI Edn, 2005
2. **CMOS- Mixed Signal Circuit Design ,**R. Jacaob Baker, (Vol ll of CMOS: Circuit Design, Layout and Stimulation), IEEE Press and Wiley Interscience, 2002.

REFERENCE BOOKS:

1. **Design of Analog CMOS Integrated Circuits**, B Razavi, First Edition, McGraw Hill,2001.
2. **CMOS Analog Circuit Design**, P e Allen and D R Holberg, Second Edition, Oxford University Press,2002.

ANTENNAS AND PROPAGATION

Subject Code	: **06EC64**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

ANTENNA BASICS: Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna filed zones.

8 Hours

UNIT - 2

POINT SOURCES AND ARRAYS: Introduction, point sources, power patterns, power theorem, radiation intensity, filed patterns, phase patterns. Array of two isotropic point sources, non-isotropic but similar point sources, principles of pattern multiplication, examples of pattern synthesis by pattern multiplication, non-isotropic point sources, broad side array with non uni polar amplitude distribution, broad side versus end fire array, direction of maxima fire arrays of n isotropic point sources of equal amplitude and spacing.

10 Hours

UNIT - 3

ELECTRIC DIPOLES AND THIN LINEAR ANTENNAS: Introduction, short electric dipole, fields of a short dipole, radiation resistance of short dipole, radiation resistances of lambda/2 Antenna, thin linear antenna, micro strip arrays, low side lobe arrays, long wire antenna, folded dipole antennas.

6 Hours

PART - B

UNIT - 4 & 5

LOOP, SLOT, PATCH AND HORN ANTENNA: Introduction, small loop, comparison of far fields of small loop and short dipole, loop antenna general case, far field patterns of circular loop, radiation resistance, directivity, slot antenna, Balinet's principle and complementary antennas, impedance of complementary and slot antennas, patch antennas, horn antennas, rectangular horn antennas.

10 Hours

UNIT - 6

ANTENNA TYPES: Helical Antenna, Yagi-Uda array, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeve antenna, turnstile antenna, omni directional antennas, antennas for satellite antennas for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna.

6 Hours

UNIT - 7 & 8

RADIO WAVE PROPAGATION: Introduction, Ground wave propagation, free space propagation, ground reflection, surface wave, diffraction.

TROPOSPHERE WAVE PROPAGATION: Troposcopic scatter, Ionosphere propagation, electrical properties of the ionosphere, effects of earth's magnetic field.

12 Hours

TEXT BOOKS:

1. **Antennas**, John D. Krauss, III (SEI) edition, McGraw-Hill International edition, 2006
2. **Antennas and Wave Propagation** - Harish and Sachidananda: Oxford Press 2007

REFERENCE BOOKS:

1. **Antenna Theory Analysis and Design** - C A Balanis, 2nd ED, John Wiley, 1997
2. **Antennas and Propagation for Wireless Communication Systems** - Sineon R Saunders, John Wiley, 2003.
3. **Antennas and wave propagation -** G S N Raju: Pearson Education 2005

INFORMATION THEORY AND CODING

Subject Code	: **06EC65**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INFORMATION THEORY: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

6 Hours

UNIT - 2

SOURCE CODING: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.

6 Hours

UNIT - 3

FUNDAMENTAL LIMITS ON PERFORMANCE: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.

6 Hours

UNIT - 4

Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

6 Hours

PART - B

UNIT - 5

INTRODUCTION TO ERROR CONTROL CODING: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

7 Hours

UNIT - 6

Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

7 Hours

UNIT - 7

RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

7 Hours

UNIT - 8

Convolution Codes, Time domain approach. Transform domain approa

7 Hours

TEXT BOOKS:

1. **Digital and analog communication systems**, K. Sam Shanmugam, John Wiley, 1996.
2. **Digital communication**, Simon Haykin, John Wiley, 2003.

REFERENCE BOOKS:

1. **ITC and Cryptography**, Ranjan Bose, TMH, II edition, 2007
2. **Digital Communications** - Glover and Grant**;** Pearson Ed. 2nd Ed 2008

ADVANCED COMMUNICATION LAB

Subject Code	: **06ECL67**	IA Marks	: 25
No. of Practical Hrs/Week: 03		Exam Hours	: 03
Total no. of Practical Hrs. : 42		Exam Marks	: 50

LIST OF EXPERIMENTS

1. TDM of two band limited signals.
2. ASK and FSK generation and detection
3. PSK generation and detection
4. DPSK generation and detection
5. QPSK generation and detection
6. PCM generation and detection using a CODEC Chip
7. Measurement of losses in a given optical fiber (propagation loss, bending loss) and numerical aperture
8. Analog and Digital (with TDM) communication link using optical fiber.
9. Measurement of frequency, guide wavelength, power, VSWR and attenuation in a microwave test bench
10. Measurement of directivity and gain of antennas: Standard dipole (or printed dipole), microstrip patch antenna and Yagi antenna (printed).
11. Determination of coupling and isolation characteristics of a stripline (or microstrip) directional coupler
12. (a) Measurement of resonance characteristics of a microstrip ring resonator and determination of dielectric constant of the substrate. (b) Measurement of power division and isolation characteristics of a microstrip 3 dB power divider.

MICROPROCESSOR LAB

Subject Code	: **06ECL68**	IA Marks	: 25
No. of Practical Hrs/Week: 03		Exam Hours	: 03
Total no. of Practical Hrs. : 42		Exam Marks	: 50

I) **Programs involving**

1) Data transfer instructions like:
   i] Byte and word data transfer in different addressing modes.
   ii] Block move (with and without overlap)
   iii] Block interchange

2) Arithmetic & logical operations like:

i] Addition and Subtraction of multi precision nos.
ii] Multiplication and Division of signed and unsigned Hexadecimal nos.
iii] ASCII adjustment instructions
iv] Code conversions
v] Arithmetic programs to find square cube, LCM, GCD, factorial

3) Bit manipulation instructions like checking:
   i] Whether given data is positive or negative
   ii] Whether given data is odd or even
   iii] Logical 1's and 0's in a given data
   iv] 2 out 5 code
   v] Bit wise and nibble wise palindrome

4) Branch/Loop instructions like:
   i] Arrays: addition/subtraction of N nos.
   Finding largest and smallest nos.
   Ascending and descending order
   ii] Near and Far Conditional and Unconditional jumps, Calls and Returns

5) Programs on String manipulation like string transfer, string reversing, searching for a string, etc.

6) Programs involving Software interrupts
   Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console

II) Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output-PCI bus compatible) card
   a) Matrix keyboard interfacing
   b) Seven segment display interface
   c) Logical controller interface
   d) Stepper motor interface

III) Other Interfacing Programs
   a) Interfacing a printer to an X86 microcomputer
   b) PC to PC Communication

ELECTIVE – GROUP A

PROGRAMMING IN C++

Subject Code	: **06EC661**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

C++, AN OVERVIEW: Getting started, the C++ program, Preprocessor Directives, The Built-In Array Data Type, Dynamic Memory Allocation and Pointers, An Object – based Design, An Object-Oriented Design, An Exception – based Design, An array.

6 Hours

UNIT - 2

THE BASIC LANGUAGE: Literal Constant, Variables, Pointer Type, String Types, const Qualifier, Reference Types, the bool type, Enumeration types, Array types. The vector container type.

6 Hours

UNIT - 3

OPERATORS: Arithmetic Operators, Equality, Relational and Logical operators, Assignment operators, Increment and Decrement operator, The conditional Operator, Bitwise operator, bitset operations. Statements: if, switch, for Loop, while, break, goto, continue statements.

10 Hours

UNIT - 4

FUNCTIONS: Prototype, Argument passing, Recursion and linear function.

4 Hours

PART - B

UNIT - 5

EXCEPTION HANDLING: Throwing an Exception, Catching an exception, Exception Specification and Exceptions and Design Issues.

6 Hours

UNIT - 6

CLASSES: Definition, Class Objects, Class Initailization, Class constructior, The class destructor, Class Object Arrays and Vectors.

7 Hours

UNIT - 7

Overload Operators, Operators ++ and --, Operators new and delete.

7 Hours

UNIT - 8

Multiple Inheritances**,** public, private & protected inheritance, Class scope under Inheritance.

6 Hours

TEXT BOOK:

1. **C++ Primer**, S. B. Lippman & J. Lajoie, 3rd Edition, Addison Wesley, 2000.

REFERENCE BOOKS:

1. **C++ Program Design: An Introduction to Programming and Object- Oriented Design**. Cohoon and Davidson, 3rd Edn. TMH publication. 2004.
2. **Object Oriented Programming using C++**, R. Lafore, Galgotia Publications, 2004.

SATELLITE COMMUNICATION

Subject Code	: **06EC662**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

OVER VIEW OF SATELLITE SYSTEMS: Introduction, frequency allocation, INTEL Sat.

3 Hours

UNIT - 2

ORBITS: Introduction, Kepler laws, definitions, orbital element, apogee and perigee heights, orbit perturbations, inclined orbits, calendars, universal time, sidereal time, orbital plane, local mean time and sun synchronous orbits, Geostationary orbit: Introduction, antenna, look angles, polar mix antenna, limits of visibility, earth eclipse of satellite, sun transit outage, leandiag orbits.

10 Hours

UNIT - 3

PROPAGATION IMPAIRMENTS AND SPACE LINK: Introduction, atmospheric loss, ionospheric effects, rain attenuation, other impairments.

SPACE LINK: Introduction, EIRP, transmission losses, link power budget, system noise, CNR, uplink, down link, effects of rain, combined CNR.

8 Hours

UNIT - 4

SPACE SEGMENT: Introduction, power supply units, altitude control, station keeping, thermal control, TT&C, transponders, antenna subsystem.

6 Hours

PART - B

UNIT - 5 & 6

EARTH SEGEMENT: Introduction, receive only home TV system, out door unit, indoor unit, MATV, CATV, Tx – Rx earth station.

6 Hours

INTERFERENCE AND SATELLITE ACCESS: Introduction, interference between satellite circuits, satellite access, single access, pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA, down link analysis, comparison of uplink power requirements for TDMA & FDMA, on board signal processing satellite switched TDMA.

9 Hours

UNIT - 7 & 8

DBS, SATELLITE MOBILE AND SPECIALIZED SERVICES: Introduction, orbital spacing, power ratio, frequency and polarization, transponder capacity, bit rates for digital TV, satellite mobile services, USAT, RadarSat, GPS, orb communication and iridium.

10 Hours

TEXT BOOK:

1. **Satellite Communications**, Dennis Roddy, 4th Edition, McGraw-Hill International edition, 2006.

REFERENCES BOOKS:

1. **Satellite Communications**, Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, John Wiley & Sons, 2003.
2. **Satellite Communication Systems Engineering**, W. L. Pitchand, H. L. Suyderhoud, R. A. Nelson, 2nd Ed., Pearson Education., 2007.

RANDOM PROCESSES

Subject Code	: **06EC663**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION TO PROBABILITY THEORY: Experiments, sample space, Events, Axioms, Assigning probabilities, Joint and conditional probabilities, Baye's Theorem, Independence, Discrete Random Variables, Engg Example.

7 Hours

UNIT - 2

Random Variables, Distributions, Density Functions: CDF, PDF, Gaussian random variable, Uniform Exponential, Laplace, Gamma, Erlang, Chi-Square, Raleigh, Rician and Cauchy types of random variables

6 Hours

UNIT - 3

OPERATIONS ON A SINGLE R V: Expected value, EV of Random variables, EV of functions of Random variables, Central Moments, Conditional expected values.

7 Hours

UNIT - 4

Characteristic functions, Probability generating functions, Moment generating functions, Engg applications, Scalar quantization, entropy and source coding.

6 Hours

PART - B

UNIT - 5

Pairs of Random variables, Joint CDF, joint PDF, Joint probability mass functions, Conditional Distribution, density and mass functions, EV involving pairs of Random variables, Independent Random variables, Complex Random variables, Engg Application.

7 Hours

UNIT - 6

MULTIPLE RANDOM VARIABLES: Joint and conditional PMF, CDF, PDF,.EV involving multiple Random variables, Gaussian Random variable in multiple dimension, Engg application, linear prediction.

7 Hours

UNIT - 7

RANDOM PROCESS: Definition and characterization, Mathematical tools for studying Random Processes, Stationary and Ergodic Random processes, Properties of ACF.

6 Hours

UNIT - 8

EXAMPLE PROCESSES: Markov processes, Gaussian Processes, Poisson Processes, Engg application, Computer networks, Telephone networks.

6 Hours

TEXT BOOK:

1. **Probability and random processes: application to Signal processing and communication** - S L Miller and D C Childers**:** Academic Press / Elsivier 2004

REFERENCE BOOKS:

1. **Probability, Random variables and stochastic processes** - A. Papoullis and S U Pillai: McGraw Hill 2002
2. **Probability, Random variables and Random signal principles** - Peyton Z Peebles**:** TMH 4th Edition 2007
3. **Probability, random processes and applications** - H Stark and Woods**:** PHI 2001

ADAPTIVE SIGNAL PROCESSING

Subject Code	: **06EC664**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

ADAPTIVE SYSTEMS: Definition and characteristics, Areas of application, General properties, Open-and closed-loop adaptation, Applications of closed-loop adaptation, Example of an adaptive system.

4 Hours

UNIT - 2

THE ADAPTIVE LINEAR COMBINER: General description, Input signal and weight vectors, Desired response and error, the performance function, gradient and minimum mean-square error, Example of a performance surface, Alternative expression of the gradient, Decorrelation of error and input components.

7 Hours

UNIT - 3

PROPERTIES OF THE QUADRATIC PERFORMANCE SURFACE: Normal of the input correlation matrix, Eigen values and Eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigenvectors and Eigen values, a second example.

8 Hours

UNIT - 4

SEARCHING THE PERFORMANCE SURFACE: Methods of searching the performance surface, Basic ideal of gradient search methods, a simple gradient search algorithm and its solution, Stability and rate of convergence, The learning curve, Gradient search by Newton's method in multidimensional space, Gradient search by the method of steepest descent, Comparison of learning curves.

7 Hours

PART - B

UNIT - 5

GRADIENT ESTIMATION AND ITS EFFECTS ON ADAPTATION: Gradient component estimation by derivate measurement, the performance penalty, Derivative measurement and performance penalties with multiple weights, variance of the gradient estimate, effects on the weight-over solution, excess mean-square error and time constants, mis adjustment, comparative performance of Newton's and steepest-descent methods, Total mis adjustment and other practical considerations.

6 Hours

UNIT - 6

THE LMS ALGORITHM: Derivation of the LMS algorithm, convergence of the weight vector, an example of convergence, learning curve, noise in the weight-vector solution, misadjustment, performance.

5 Hours

UNIT - 7

ADAPTIVE MODELING AND SYSTEM IDENTIFICATION: General description, Adaptive modeling of multipath communication channel, adaptive modeling in geophysical exploration, Adaptive modeling in FIR digital filter synthesis.

5 Hours

UNIT - 8

ADAPTIVE INTERFACING CANCELING: The concept of adaptive noise canceling, stationary noise-canceling solutions, effects of signal components in the reference input, The adaptive interference canceller as a notch filter, The adaptive interface canceller as a high-pass filter, Effects of finite length and causality, multiple-reference noise canceling.

7 Hours

TEXT BOOK:

1. **Adaptive Signal Processing**, Bernard Widrow and Samuel D. Stearns, Pearson Education Asia, 2001.

REFERENCE BOOKS:

1. **Adaptive filter Theory**, Simon Haykin, 4e, Pearson Education Asia, 2002
2. **Theory and Design of Adaptive Filters**, Jophn R. Treichler C. Richard Johnson, Jr. and Michael G. Larimore, Pearson education / PHI 2002.

LOW POWER VLSI DESIGN

Subject Code	: **06EC665**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction, Sources of power dissipation, designing for low power. Physics of power dissipation in MOSFET devices – MIS Structure, Long channel and sub-micron MOSFET, Gate induced Drain leakage.

6 Hours

UNIT - 2

Power dissipation in CMOS – Short circuit dissipation, dynamic dissipation, Load capacitance. Low power design limits - Principles of low power design, Hierarchy of limits, fundamental limits, Material, device, circuit and system limits.

8 Hours

UNIT – 3&4

SYNTHESIS FOR LOW POWER: Behavioral, Logic and Circuit level approaches, Algorithm level transforms, Power-constrained Least squares optimization for adaptive and non-adaptive filters, Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre- computation, FSM and Combinational logic, Transistor sizing.

12 Hours

PART - B

UNIT – 5&6

DESIGN AND TEST OF LOW-VOLTAGE CMOS CIRCUITS: Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect, Low voltage design techniques using reverse V_{gs}, steep sub threshold swing and multiple threshold voltages, Testing with elevated intrinsic leakage, multiple supply voltages.

12 Hours

UNIT - 7

LOW ENERGY COMPUTING: Energy dissipation in transistor channel, Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and I/O Buffer, supply clock generation.

8 Hours

UNIT - 8

SOFTWARE DESIGN FOR LOW POWER: Introduction, sources of power dissipation, power estimation and optimization.

6 Hours

TEXT BOOK:

1. **Low-Power CMOS VLSI Circuit Design**, Kaushik Roy and Sharat C Prasad, Wiley Inter science, 2000.

MODERN CONTROL THEORY

Subject Code	: **06EC666**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

LINEAR SPACES AND LINEAR OPERATORS: Introduction, Fields, Vectors and Vector Spaces, Linear Combinations and Bases, Linear Transformations and Matrices, Scalar Product and Norms, Solution of Linear Algebraic Equations, Eigen values, Eigen vectors and a Canonical-Form, Functions of a Square Matrix.

7 Hours

UNIT - 2

STATE VARIABLE DESCRIPTIONS: Introduction, The Concept of State, State Equations for Dynamic Systems, Time-Invariance and Linearity, Non uniqueness and State Model, State diagrams.

6 Hours

UNIT - 3

PHYSICAL SYSTEMS AND STATE ASSIGNMENT: Introduction, Linear Continuous-Time Models, Linear Discrete-Time Models, Nonlinear Models, Local Linearization of Nonlinear Models, Plant Models of some Illustrative Control Systems.

6 Hours

UNIT - 4

SOLUTIONS OF STATE EQUATIONS: Introduction, Existence and Uniqueness of Solutions to Continuous –Time State Equations, Solution of Nonlinear Continuous-Time Equations, Solution of Linear Time-Varying Continuous –Time State Equations, Solution of Linear Time- Invariant

continuous-Time State Equations, Solution of Linear Discrete-Time State Equations, State Equations of Sampled –Data Systems.

7 Hours

PART - B

UNIT - 5

CONTROLLABILITY AND OBSERVABILITY: Introduction, General Concept of Controllability, General Concept of Observability, Controllability Tests for Continuous-Time Systems, Observability Tests for Continuous-Time Systems, Controllability and Observability of Discrete-Time Systems, Controllability and Observability of State Model in Jordan Canonical Form, Loss of Controllability and Observability due to Sampling, Controllability and Observability, Canonical Forms of State Model.

7 Hours

UNIT - 6

RELATIONSHIP BETWEEN STATE VARIABLE AND INPUT-OUTPUT DESCRIPTIONS: Introduction, Input-output Maps from State Models, Output Controllability, Reducibility, State models from Input-Output Maps.

7 Hours

UNIT - 7

STABILITY: Introduction, Stability Concepts and Definitions, Stability of Linear Time-Invariant Systems, Equilibrium Stability of Nonlinear Continuous-Time Autonomous Systems, The Direct Method of Lyapunov and the Linear Continuous-Time Autonomous Systems, Aids to Finding Lyapunov Functions for Nonlinear Continuous-Time Autonomous Systems, Use of Lyapunov Functions to Estimate Transients, The Direct Method of Lyapunov and the Discrete-Time Autonomous Systems.

6 Hours

UNIT - 8

MODEL CONTROL: Introduction, Controllable and Observable Companion Forms, The effect of State Feedback on Controllability and Observability, Pole Placement by State Feedback, Full-Order Observers, Reduced-Order Observers, Deadbeat Control by State Feedback, Deadbeat Observers

6 Hours

TEXT BOOK:

1. **Modern Control System Theory** - M. Gopal: 2nd Edition; New Age Int (P) Ltd. 2007

REFERENCE BOOKS:

1. **Modern Control System** – Richard Dorf & Robert Bishop Pearson Education/ PHI.
2. **Modern Control Engineering** - K. Ogata Pearson Education / PHI

DIGITAL SYSTEMS DESIGN USING VHDL

Subject Code	: **06EC667**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

7 Hours

UNIT - 2

DESIGNING WITH PROGRAMMABLE LOGIC DEVICES: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

6 Hours

UNIT - 3

DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

6 Hours

UNIT - 4

DIGITAL DESIGN WITH SM CHARTS: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

7 Hours

PART - B

UNIT - 5

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

6 Hours

UNIT - 6

FLOATING - POINT ARITHMETIC: Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations.

7 Hours

UNIT - 7

ADDITIONAL TOPICS IN VHDL: Attributes, Transport and Inertial delays, Operator overloading, Multi-valued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and Text IO.

7 Hours

UNIT - 8

VHDL MODELS FOR MEMORIES AND BUSES: Static RAM, A simplified 486 bus model, Interfacing memory to a microprocessor bus.

6 Hours

TEXT BOOK:

1. **Digital Systems Design using VHDL**, Charles H. Roth. Jr:, Thomson Learning, Inc, 9th reprint, 2006.

REFERENCE BOOKS:

1. **Fundamentals of Digital Logic Design with VHDL**, Stephen Brwon & Zvonko Vranesic, Tata McGrw-Hill, New Delhi, 2nd Ed., 2007
2. **Digital System Design with VHDL**, Mark Zwolinski, 2 Ed, Pearson Education., 2004
3. **Digital Electronics and Design with VHDL -** Volnei A Pedroni, Elsivier Science, 2009

VII SEMESTER

COMPUTER COMMUNICATION NETWORKS

Subject Code	: **06EC71**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Layered tasks, OSI Model, Layers in OSI model, TCP?IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission.

6 Hours

UNIT - 2

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC.

7 Hours

UNIT - 3

MULTIPLE ACCESSES: Random access, Controlled access, Channelisation.

6 Hours

UNIT - 4

Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11

7 Hours

PART - B

UNIT - 5

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Back bone Networks, Virtual LANs

6 Hours

UNIT - 6

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6.

7 Hours

UNIT - 7

Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols

6 Hours

UNIT - 8

Transport layer Process to process Delivery, UDP, TCP, Domain name system, Resolution

6 Hours

TEXT BOOK:

1. **Data Communication and Networking**, B Forouzan**,** 4th Ed, TMH 2006

REFERENCE BOOKS:

1. **Computer Networks**, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
2. **Introduction to Data communication and Networking**, Wayne Tomasi: Pearson education 2007

OPTICAL FIBER COMMUNICATION

Subject Code	: **06EC72**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

OVERVIEW OF OPTICAL FIBER COMMUNICATION: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.

8 Hours

UNIT - 2

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: Introduction, **A**ttenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

5 Hours

UNIT - 3

OPTICAL SOURCES AND DETECTORS: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors.

7 Hours

UNIT - 4

FIBER COUPLERS AND CONNECTORS: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

6 Hours

PART - B

UNIT - 5

OPTICAL RECEIVER: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers

6 Hours

UNIT - 6

ANALOG AND DIGITAL LINKS: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.

Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

8 Hours

UNIT - 7

WDM CONCEPTS AND COMPONENTS: WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

6 Hours

UNIT - 8

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

6 Hours

TEXT BOOKS:

1. **"Optical Fiber Communication"**, Gerd Keiser, 4th Ed., MGH, 2008.
2. **"Optical Fiber Communications"**, John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCE BOOK:

1. **Fiber Optic Communication** - Joseph C Palais: 4th Edition, Pearson Education.

POWER ELECTRONICS

Subject Code	: **06EC73**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction, Applications of power electronics, Power semiconductor devices, Control characteristics, Types of power electronics circuits, Peripheral effects.

5 Hours

UNIT - 2

POWER TRANSISTOR: Power BJT's, Switching characteristics, Switching limits, Base derive control, Power MOSFET's, Switching characteristics, Gate drive, IGBT's, Isolation of gate and base drives.

6 Hours

UNIT - 3

INTRODUCTION TO THYRISTORS: Principle of operation states anode-cathode characteristics, Two transistor model. Turn-on Methods, Dynamic Turn-on and turn-off characteristics, Gate characteristics, Gate trigger circuits, di / dt and dv / dt protection, Thyristor firing circuits.

7 Hours

UNIT - 4

CONTROLLED RECTIFIERS: Introduction, Principles of phase controlled converter operation, 1φ fully controlled converters, Duel converters, 1 φ semi converters (all converters with R & RL load).

5 Hours

PART - B

UNIT - 5

Thyristor turn off methods, natural and forced commutation, self commutation, class A and class B types, Complementary commutation, auxiliary commutation, external pulse commutation, AC line commutation, numerical problems.

7 Hours

UNIT - 6

AC VOLTAGE CONTROLLERS: Introduction, Principles of on and off control, Principles of phase control, Single phase controllers with restive loads and Inductive loads, numerical problems.

6 Hours

UNIT - 7

DC CHOPPERS: Introduction, Principles of step down and step up choppers, Step down chopper with RL loads, Chopper classification,

Analysis of impulse commutated Thyristor chopper (only qualitative analysis).

8 Hours

UNIT - 8

INVERTORS: Introduction, Principles of operation, Performance parameters, 1φ bridge inverter, voltage control of 1φ invertors, current source invertors, Variable DC link inverter.

7 Hours

TEXT BOOKS:

1. **"Power Electronics" -** M. H. Rashid 3rd edition, PHI / Pearson publisher 2004.
2. **"Power Electronics" -** M. D. Singh and Kanchandani K.B. TMH publisher, 2nd Ed. 2007.

REFERENCE BOOKS:

1. **"Thyristorized Power Controllers" -** G. K. Dubey S. R. Doradla, A. Joshi and Rmk Sinha New age international (P) ltd reprint 1999.
2. **"Power Electronics" -** Cynil W. Lander 3rd edition, MGH 2003.

DSP ALGORITHMS AND ARCHITECTURE

Subject Code	: **06EC74**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

5 Hours

UNIT - 2

ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

8 Hours

UNIT - 3

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of

TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control.

6 Hours

UNIT - 4

Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.

6 Hours

PART - B

UNIT - 5

IMPLEMENTATION OF BASIC DSP ALGORITHMS: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

6 Hours

UNIT - 6

IMPLEMENTATION OF FFT ALGORITHMS: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS32OC54xx.

6 Hours

UNIT - 7

INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO DSP DEVICES: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

8 Hours

UNIT - 8

INTERFACING AND APPLICATIONS OF DSP PROCESSOR: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

6 Hours

TEXT BOOK:

1. **"Digital Signal Processing"**, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. **Digital Signal Processing: A practical approach**, Ifeachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
2. **"Digital Signal Processors"**, B Venkataramani and M Bhaskar TMH, 2002
3. **"Architectures for Digital Signal Processing"**, Peter Pirsch John Weily, 2007

VLSI LAB

Subject Code	: **06ECL77**	IA Marks	: 25
No. of Practical Hrs/Week	: 03	Exam Hours	: 03
Total no. of Practical Hrs.	: 42	Exam Marks	: 50

PART - A

DIGITAL DESIGN

ASIC-DIGITAL DESIGN FLOW

1. Write Verilog Code for the following circuits and their Test Bench for **verification**, observe the waveform and **synthesise** the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

i. An inverter
ii. A Buffer
iii. Transmission Gate
iv. Basic/universal gates
v. Flip flop -RS, D, JK, MS, T
vi. Serial & Parallel adder
vii. 4-bit counter [Synchronous and Asynchronous counter]
viii. Successive approximation register [SAR]

* *An appropriate constraint should be given*

PART - B
ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:

a. **Draw the schematic** and verify the following
   i) DC Analysis
   ii) Transient Analysis
b. **Draw the Layout** and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design
e. Verify & Optimize for Time, Power and Area to the given constraint***

2. Design the following circuits with given specifications*, completing the design flow mentioned below:

a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.
   i) A Single Stage differential amplifier
   ii) Common source and Common Drain amplifier

3. Design an **op-amp** with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:

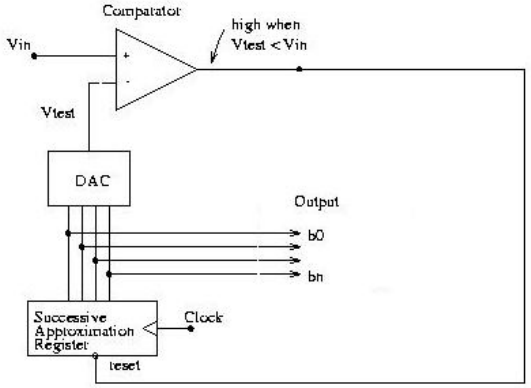
a. Draw the schematic and verify the following
   i) DC Analysis
   ii). AC Analysis
   iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.

4. Design a **4 bit R-2R based DAC** for the given specification and completing the design flow mentioned using given op-amp in the library**.

a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.

5. For the **SAR based ADC** mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.

[Specifications to GDS-II]



* Appropriate specification should be given.
** Applicable Library should be added & information should be given to the Designer.
*** An appropriate constraint should be given

POWER ELECTRONICS LAB

Subject Code	: **06ECL78**	IA Marks	: 25
No. of Practical Hrs/Week: 03		Exam Hours	: 03
Total no. of Practical Hrs. : 42		Exam Marks	: 50

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT.
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using i) LC circuit ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ trials using digital circuits / microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of a separately exited DC motor.
11. Speed control of universal motor.
12. Speed control of stepper motor.
13. Parallel / series inverter.

Note: Experiments to be conducted with isolation transformer and low voltage

OPERATING SYSTEMS

Subject Code	: **06EC751**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION AND OVERVIEW OF OPERATING SYSTEMS: Operating system, Goals of an O.S, Operation of an O.S, Resource allocation and related functions, User interface related functions, Classes of operating systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems.

7 Hours

UNIT - 2

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of the supervisor, Configuring and installing of the supervisor, Operating system with monolithic structure, layered design, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems.

7 Hours

UNIT - 3

PROCESS MANAGEMENT: Process concept, Programmer view of processes, OS view of processes, Interacting processes, Threads, Processes in UNIX, Threads in Solaris**.**

6 Hours

UNIT - 4

MEMORY MANAGEMENT: Memory allocation to programs, Memory allocation preliminaries, Contiguous and noncontiguous allocation to programs, Memory allocation for program controlled data, kernel memory allocation.

6 Hours

PART - B

UNIT - 5

VIRTUAL MEMORY: Virtual memory basics, Virtual memory using paging, Demand paging, Page replacement, Page replacement policies, Memory allocation to programs, Page sharing, UNIX virtual memory.

6 Hours

UNIT - 6

FILE SYSTEMS: File system and IOCS, Files and directories, Overview of I/O organization, Fundamental file organizations, Interface between file

system and IOCS, Allocation of disk space, Implementing file access, UNIX file system.

7 Hours

UNIT - 7

SCHEDULING: Fundamentals of scheduling, Long-term scheduling, Medium and short term scheduling, Real time scheduling, Process scheduling in UNIX.

7 Hours

UNIT - 8

MESSAGE PASSING: Implementing message passing, Mailboxes, Inter process communication in UNIX.

6 Hours

TEXT BOOK:

1. **"Operating Systems - A Concept based Approach"**, D. M. Dhamdhare, TMH, 2nd Ed, 2006.

REFERENCE BOOK:

1. **Operating Systems Concepts**, Silberschatz and Galvin, John Wiley, 5th Edition, 2001.
2. **Operating System – Internals and Design Systems**, Willaim Stalling, Pearson Education, 4th Ed, 2006.

PATTERN RECOGNITION

Subject Code	: **06EC752**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Applications of pattern recognition, statistical decision theory, image processing and analysis.

4 Hours

UNIT - 2

PROBABILITY: Introduction, probability of events, random variables, Joint distributions and densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

7 Hours

UNIT - 3

STATISTICAL DECISION MAKING: Introduction, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, the leaving-one-out technique. Characteristic curves, estimating the composition of populations.

7 Hours

UNIT - 4

NONPARAMETRIC DECISION MAKING: Introduction, histograms, Kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate Functions, minimum squared error discriminate functions, choosing a decision making technique.

8 Hours

PART - B

UNIT - 5

CLUSTERING: Introduction, hierarchical clustering, partitional clustering.

7 Hours

UNIT - 6

ARTIFICIAL NEURAL NETWORKS: Introduction, nets without hidden layers. nets with hidden layers, the back Propagation algorithms, Hopfield nets, an application.

7 Hours

UNIT - 7

PROCESSING OF WAVEFORMS AND IMAGES: Introduction, gray level sealing transfoniiations, equalization, geometric image and interpolation, Smoothing, transformations, edge detection, Laplacian and sharpening operators, line detection and template matching, logarithmic gray level sealing, the statistical significance of image features.

12 Hours

REFERENCE BOOKS:

1. **"Pattern Recognition and Image Analysis"**, Eart Gose, Richard Johnsonburg and Steve Joust, Prentice-Hall of India-2003.
2. **"Pattern recognition (Pattern recognition a scene analysis)"** Duda and Hart.
3. **"Pattern recognition: Statistical, Structural and neural approaches"**, Robert J Schalkoff, John Wiley.

ARTIFICIAL NEURAL NETWORKS

Subject Code	: **06EC753**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction, history, structure and function of single neuron, neural net architectures, neural learning, use of neural networks.

7 Hours

UNIT - 2

Supervised learning, single layer networks, perceptions, linear separability, perceptions training algorithm, guarantees of success, modifications.

6 Hours

UNIT - 3

Multiclass networks-I, multilevel discrimination, preliminaries, back propagation, setting parameter values, theoretical results.

6 Hours

UNIT - 4

Accelerating learning process, application, mandaline, adaptive multilayer networks.

7 Hours

PART - B

UNIT - 5

Prediction networks, radial basis functions, polynomial networks, regularization, unsupervised learning, winner take all networks.

6 Hours

UNIT - 6

Learning vector quantizing, counter propagation networks, adaptive resonance theorem, toplogically organized networks, distance based learning, neo-cognition.

6 Hours

UNIT - 7

Associative models, hop field networks, brain state networks, Boltzmann machines, hetero associations.

7 Hours

UNIT - 8

Optimization using hop filed networks, simulated annealing, random search, evolutionary computation.

6 Hours

TEXT BOOK:

1. **Elements of Artificial Neural Networks**, Kishan Mehrotra, C. K. Mohan, Sanjay Ranka, Penram, 1997.

REFERENCE BOOKS:

1. **Artificial Neural Networks**, R. Schalkoff, MGH, 1997.
2. **Introduction to Artificial Neural Systems**, J. Zurada, Jaico, 2003.
3. **Neural Networks,** Haykins, Pearson Edu., 1999.

CAD FOR VLSI

Subject Code	: **06EC754**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT – 1&2

INTRODUCTION TO VLSI METHODOLOGIES: VLSI Physical Design Automation - Design and Fabrication of VLSI Devices - Fabrication process and its impact on Physical Design.

13 Hours

UNIT – 3&4

A QUICK TOUR OF VLSI DESIGN AUTOMATION TOOLS: Data structures and Basic Algorithms, Algorithmic Graph theory and computational complexity, Tractable and Intractable problems.

13 Hours

PART B

UNIT – 5&6

GENERAL PURPOSE METHODS FOR COMBINATIONAL OPTIMIZATION: partitioning, floor planning and pin assignment, placement, routing.

12 Hours

UNIT – 7&8

SIMULATION-LOGIC SYNTHESIS: Verification-High level synthesis - Compaction. Physical Design Automation of FPGAs, MCMS-VHDL-Verilog-Implementation of Simple circuits using VHDL and Verilog.

14 Hours

REFERENCE BOOKS:

1. **"Algorithms for VLSI Physical Design Automation"**, N. A. Shervani, 1999.
2. **"Algorithms for VLSI Design Automation"**, S. H. Gerez, 1998.

ATM NETWORKS

Subject Code	: **06EC755**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART- A

UNIT - 1

TRANSFER MODES: Overview of ATM, Introduction, Circuit switching, Routing, virtual circuit Switching, Comparison of transfer modes. Motivation for ATM, Basic properties.

6 Hours

UNIT - 2

ATM REFERENCE MODEL: Core aspects, ATM Networks, Architecture and interfaces, Internetworking, Applications, BISDN and ATM, ATM Standardisation.

6 Hours

UNIT - 3

ATM PHYSICAL LAYER: TC sub layer, PMD sub layer, DS1 interface, DS3 interface, E1 Interface, E3 interface, SONET/SDH based interface.

6 Hours

UNIT - 4

ATM Layer and AAL, ATM cell header at UNI and NNI, ATM layer function, AAL1, AAL2, AAL3/4.

8 Hours

PART - B

UNIT - 5

ATM traffic and traffic management, Traffic parameters, Service parameters, QOS parameters, Service categories, Traffic management, Traffic contact management.

6 Hours

UNIT - 6

ATM SWITCHING: Introduction, Components, Performance, Measurements, Switching issues, Shared memory architecture, Shared medium architecture, Space division architecture, Switching in ATM.

8 Hours

UNIT - 7

ATM ADDRESSING, SIGNALING AND ROUTING: AISA format, Group addressing, ATM signal protocol stack, SAAL, Routing, PNNI Protocol, PNNI hierarchy, PNNI topology.

6 Hours

UNIT - 8

ATM NETWORK MANAGEMENT AND SECURITY: Standardisation Procedure, Reference model, OAM Procedure, ILMI, Security object in ATM Security model.

6 Hours

TEXT BOOK:

1. **ATM Networks**, Sumit Kasera and Pankaj Sethi, TMH, 2001.

REFERENCE BOOKS:

1. **ATM Networks**, Rainer Handel, Manfred. N. Huber, Stefan Schroder, 3rd Edition, Pearson Education Asia, 2006
2. **Sourcebook of ATM and IP Internetworking**, Khalid Ahmed, Wiley inter science, 2002

IMAGE PROCESSING

Subject Code	: **06EC756**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

DIGITAL IMAGE FUNDAMENTALS: What is Digital Image Processing. fundamental Steps in Digital Image Processing, Components of an Image processing system, elements of Visual Perception.

6 Hours

UNIT - 2

Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

6 Hours

UNIT - 3

IMAGE TRANSFORMS: Two-dimensional orthogonal & unitary transforms, properties of unitary transforms, two dimensional discrete Fourier transform.

6 Hours

UNIT - 4

Discrete cosine transform, sine transform, Hadamard transform, Haar transform, Slant transform, KL transform.

6 Hours

PART - B

UNIT - 5

IMAGE ENHANCEMENT: Image Enhancement in Spatial domain, Some Basic Gray Level Trans -formations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations.

6 Hours

UNIT - 6

Basics of Spatial Filtering Image enhancement in the Frequency Domain filters, Smoothing Frequency Domain filters, Sharpening Frequency Domain filters, homomorphic filtering.

6 Hours

UNIT - 7

Model of image degradation/restoration process, noise models, Restoration in the Presence of Noise, Only-Spatial Filtering Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, inverse filtering, minimum mean square error (Weiner) Filtering

10 Hours

UNIT - 8

Color Fundamentals. Color Models, Pseudo color Image Processing., processing basics of full color image processing

6 Hours

TEXT BOOK:

1. **"Digital Image Processing"**, Rafael C.Gonzalez and Richard E. Woods, Pearson Education, 2001, 2nd edition.

REFERENCE BOOKS:

1. **"Fundamentals of Digital Image Processing"**, Anil K. Jain, Pearson Edun, 2001.
2. **"Digital Image Processing and Analysis"**, B. Chanda and D. Dutta Majumdar, PHI, 2003.

APPLIED EMBEDDED SYSTEM DESIGN

Subject Code	: **06EC757**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART A

UNIT - 1

INTRODUCTION TO THE EMBEDDED SYSTEMS

An embedded system, Proessor embedded into a system, Embedded hardware units and devices in a system, Embedded software in a system, Examples of embedded systems,

Embedded system-on-chip (soc) and use of vlsi circuits design technology, Complex systems design and processors, Design process in embedded system, Formalism of system design, Design process and design examples, Classification of embedded systems, Skills required for an embedded system designer.

7 Hours

UNIT - 2

8051 and Advanced PROCESSOR Architectures

8051 Architecture, Real world interfacing, Introduction to advanced architectures, Processor and Memory organisation, Instruction Level Parallelism, Performance Metrics, Memory types and addresses, Processor Selection, Memory Selection.

3 Hours

UNIT - 3

Devices AND Communication Buses for Devices Network

I/O Types and Examples, Serial Communication Devices , Parallel Port Devices , Sophisticated Interfacing Features in Device Ports, Wireless Communication Devices, Timer and Counting Devices , Watchdog Timers , Real Time Clocks, Networking of Embedded Systems, Serial Bus Protocols, Internet Enabled Systems Network Protocols, Parallel bus device protocols-parallel communication network using the isa, pci, pci-x and advanced buses, Wireless and Mobile System Protocols.

6 Hours

UNIT - 4

DEVICE DRIVERS AND INTERRUPTS SERVICING MECHANISM

Port or device access without interrupt servicing mechanism, Interrupt service routine, Thread and device driver concept, Interrupt sources, Interrupt servicing (handling) mechanism, Multiple interrupts, Context and the periods for context-switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from context saving angle, Direct memory access. Device driver programming, Parallel port device drivers in a system. Serial port device drivers in a system, Timer devices and

devices interrupts, Context and the periods for context-switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from context saving angle, Direct memory access, Device driver programming, Parallel port device drivers in a system, Serial port device drivers in a system, Timer devices and devices interrupts.

7 Hours

PART B

UNIT - 5

PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++ and Java

Software programming in assembly language (alp) and in high level language 'C', 'C' program elements: header and source files and preprocessor directives, Program elements: macros and functions, Program elements: data types, data structures, modifiers, statements, loops and pointers. Ojected oriented programming, Embedded programming in C++ , Embedded programming in java, Otimization of memory needs.

6 Hours

UNIT - 6

PROGRAM MODELING CONCEPTS

Program models, Data flow graph models, State machine programming models for event controlled programs, Modeling of multiprocessor systems, UML modeling.

REAL TIME OPERATING SYSTEMS

Multiple processes in an application, Multiple threads in an application, Task Tasks and states, Tasks and data, Clear cut distinction between Functions, ISRs and Tasks by their Characteristics, Concept of semaphores, Shared data, Inter process communication, Signals, Semaphores, Message Queues, Mailboxes, Pipes
Sockets. Remote Procedure Calls (RPCs). **8 Hours**

UNIT - 7

REAL TIME OPERATING SYSTEMS

Process Management, Timer Functions , Event Functions, Memory management, Device, File, and IO Subsystems Management, Interrupt Routines in RTOS environment and handling of interrupt source calls by RTOS, Introduction to Real Time Operating System, Basic Design Using a Real Time Operating System, RTOS Task Scheduling Models, Latency, Response Times, Deadline as Performance Metric, Latency and Deadlines as Performance Metric in Scheduling Models For Periodic, Sporadic and Aperiodic Tasks, CPU Load as Performance Metric, Sporadic Task Model Performance Metric. OS SECURITY ISSUES, IEEE Standard POSIX 1003.1b Functions for Standardisation of RTOS and Inter Process Communication Functions.

RTOS PROGRAMMING

MicroC/OS-II and VxWorks, Types of real- time operating systems, RTOS μC/OS-II, RTOS VxWorks.

8 Hours

UNIT - 8

DESIGN EXAMPLES AND CASE STUDIES OF PROGRAM MODELING AND PROGRAMMING WITH RTOS - 1

Case study of coding for an automatic chocolate vending machine using mucos rtos Case study of digital camera case study of coding for sending application layer byte streams on a tcp/ip network using rtos vxworks.

DESIGN EXAMPLES AND CASE STUDIES OF PROGRAM MODELING AND PROGRAMMING WITH RTOS - 1

Case study of orchestra playing robots, Case study of an embedded system for an adaptive cruise control system in a car, Case study of an embedded system for a smart card, Case study of a mobile phone.

7 Hours

TEXT BOOK:

1. **Embedded Systems : Architecture, Programming, and Design,** Raj Kamal, 2nd Edn. TMH, 2008.

REFERENCE BOOKS:

1. **Bank Vahid Embedded System Design – A certified Hardware / Software Introduction,** John Wikey & Sons, 2002.
2. **An embedded Software Primer** by David E Simon, Pearson Edition 1999.

VIDEO ENGINEERING

Subject Code	: **06EC758**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

TV FUNDAMENTALS: Block schematic of TV systems, picture characteristics, luminous signal, bandwidth calculation, chromatic signal, composite video signal.

6 Hours

UNIT - 2

NTSC, PAL AND SECAM OVERVIEW: NTSC overview, luminous information, color information, color modulation, composite video generation, color sub-carrier frequency, NTSC standards, RF modulation, stereo audio. PAL overview, luminance information, color information, color modulation, composite video generation, PAL standards, RF modulation, stero audio (analog).

SECAM overview, luminance information, color information, color modulation, composite video generation, SECAM standards, Tele text, Enhanced TV programming.

6 Hours

UNIT - 3

NTSC AND PAL DIGITAL ENCODING – DECODING: NTSC & PAL encoding, luminance, Y processing, color difference processing, C modulation, analog C generation, analog composite video, clear encoding, NTSC & PAL decoding.

10 Hours

UNIT - 4

VIDEO CONFERENCING STANDARDS: (H.261 & H.263) - H.261, video coding layers, DCT, IDCT, video bit stream, block layer, still image transmission, H.263, video coding layer, GOB layer, MB layer, optional H.263 modes.

6 Hours

PART - B

UNIT - 5 & 6

MPEG 1, 2, 4 AND H.261: Introduction, MPEG vs JPEG, Quality issues, audio overview, video coding layer, I P B, D frames, video bit stream, video decoding, real world issues.

MPEG 2: Introduction, audio overview, video overview, video coding layer, enhances TV programming, IPMP.

MPEG 4 over MPEG 2, H.264 over MPEG 2, SMPTEVC-9 over MPEG 2, Data broad casting, decoder consideration. MPEG 4 & H.264: Introduction, audio overview, visual overview, Graphic overview, visual layer, object description frame work, scene description, syndronigation of elementary streams, multiplexing, IPMP, MPEG 4 part 10 (H.264) video.

15 Hours

UNIT - 7 & 8

DIGITAL VIDEO INTERFACES: Pre video component interfaces, consumer component interfaces, consumer transport interfaces.

DIGITAL VIDEO PROCESSING: Rounding considerations, SDTV – ADTV Yeber transforms, 4:4:4 to 4:2:2 Yeber conversion, display enhancement, video mixing and graphic overlay.
IPTV: Consideration, multicasting, RTS based solutions, ISMA, Broadcast over IP, DRM.

9 Hours

TEXT BOOK:

1. **Video Demystified**, Keith Jack, 4th Edn, Elsevier, 2007.

REFERENCE BOOK:

1. **Modern TV Practice**, R. R. Gulati, 2nd Edn, New age Intl. publications.

ELECTIVE-3 (GROUP-C)
DATA STRUCTURE USING C++

Subject Code	: **06EC761**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1
INTRODUCTION: Functions and parameters, Dynamic memory allocation classis, Testing and debugging. Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing simulating pointers.

9 Hours

UNIT - 2
ARRAYS AND MATRICS: Arrays, Matrices, Special matrices spare matrices.

6 Hours

UNIT - 3
STACKS: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation, Applications.

5 Hours

UNIT - 4
Queues: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked Linked representation, Applications.

6 Hours

PART - B

UNIT - 5
SKIP LISTS AND HASHING: Dictionaries, Linear representation, Skip list presentation, Hash table representation.

6 Hours

UNIT - 6

BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.

7 Hours

UNIT - 7

PRIRITY QUEUES: Linear lists, Heaps, Leftist trees.

6 Hours

UNIT-8

Search Trees: Binary search trees, B-trees, Applications.

7 Hours

TEXT BOOK:

1. **Data structures, Algorithms, and applications in C++ -** Sartaj Sahni, McGraw Hill.2000.

REFERENCE BOOKS:

1. **Object Oriented Programming in C++** - Balaguruswamy. TMH, 1995.
2. **Programming in C++** - Balaguruswamy. TMH, 1995 .

REAL-TIME SYSTEMS

Subject Code	: **06EC762**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION TO REAL-TIME SYSTEMS: Historical background, RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs.

6 Hours

UNIT - 2

CONCEPTS OF COMPUTER CONTROL: Introduction, Sequence Control, Loop control, Supervisory control, Centralised computer control, Distributed system, Human-computer interface, Benefits of computer control systems.

6 Hours

UNIT - 3

COMPUTER HARDWARE REQUIREMENTS FOR RTS: Introduction, General purpose computer, Single chip microcontroller, Specialized processors, Process-related Interfaces, Data transfer techniques, Communications, Standard Interface.

6 Hours

UNIT - 4

LANGUAGES FOR REAL-TIME APPLICATIONS: Introduction, Syntax layout and readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation, Data types, Control Structure, Exception Handling, Low-level facilities, Co routines, Interrupts and Device handling, Concurrency, Real-time support, Overview of real-time languages.

8 Hours

PART - B

UNIT - 5 & 6

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

12 Hours

UNIT - 7

DESIGN OF RTSS – GENERAL INTRODUCTION: Introduction, Specification documentation, Preliminary design, Single-program approach, Foreground/background, Multi-tasking approach, Mutual exclusion, Monitors.

8 Hours

UNIT - 8

RTS DEVELOPMENT METHODOLOGIES: Introduction, Yourdon Methodology, Requirement definition for Drying Oven, Ward and Mellor Method, Hately and Pirbhai Method.

6 Hours

TEXT BOOKS:

1. **Real - Time Computer Control- An Introduction**, Stuart Bennet, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real-Time Systems Design and Analysis**, Phillip. A. Laplante, second edition, PHI, 2005.

2. **Real-Time Systems Development**, Rob Williams, Elsevier. 2006.
3. **Embedded Systems**, Raj Kamal, Tata Mc Graw Hill, India, 2005.

RADIO FREQUENCY INTEGRATED CIRCUITS

Subject Code	: **06EC763**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

OVERVIEW OF WIRELESS PRINCIPLES: A brief history of wireless systems, Noncellular wireless applications, Shannon, Modulations & Alphabet Soup, Propagation.

PASSIVE RLC NETWORKS: Introduction, Parallel RLC Tank, Series RLC Networks, Other RLC networks, RLC Networks as impedance Transformers.

7 Hours

UNIT - 2

CHARACTERISTICS OF PASSIVE IC COMPONENTS: Introduction, Interconnect at radio frequencies: Skin effect, resisters, Capacitors, Inductors, Transformers, Interconnect options at high frequency.

7 Hours

UNIT - 3

A REVIEW OF MOS DEVICE PHYSICS: Introduction, A little history, FETs, MOSFET physics, The long – channels approximation, operation in weak inversion (sub threshold), MOS device physics in the short – channel regime, Other effects.

DISTRIBUTED SYSTEMS: Introduction, Link between lumped and distributed regimes driving-point impedance of iterated structures, Transmission lines in more detail, Behavior of Finite – length transmission lines, summary of transmission line equations, artificial lines.

6 Hours

UNIT - 4

THE SMITH CHART AND S-PARAMETERS: Introduction, The smith chart, S-parameters, Band Width Estimation Techniques, Introduction, The method of open – circuit time constant, The method of short circuit time constant, Risetime, Delay and bandwidth.

6 Hours

PART - B

UNIT - 5

HIGH FREQUENCY AMPLIFIER DESIGN: Introduction, Zeros as bandwidth Enhancers, The shunt –series amplifier, Bandwidth Enhancement with f_T Doublers, Tuned amplifiers, Neutralization and unilateralization, Cascaded amplifiers, AM – PM conversion.

6 Hours

UNIT - 6

VOLTAGE REFERENCES AND BIASING: Introduction, Review of diode behavior, Diodes and bipolar transistors in CMOS technology, Supply –independent bias circuits, Bandgap voltage reference, Constant g_m bias. **Noise**: Introduction, Thermal noise, Shot noise, Flicker noise, Popcorn noise, Classical two- port noise theory, Examples of noise calculations, A handy rule of thumb, Typical noise performance.

6 Hours

UNIT - 7

LOW NOISE AMPLIFIER DESIGN: Introduction, Derivation of intrinsic MOSFET two-port noise parameters, LNA topologies: Power match versus noise match, Power-constrained noise optimization, Design examples, linearity and large signal performance, Spurious – free Dynamic range. **Mixers:** Introduction, Mixer fundamental, Nonlinear systems as linear mixers.

7 Hours

UNIT - 8

Multiplier – based mixers, Sub sampling mixers, Diode ring mixers, RF power amplifiers, Introduction, general considerations, Class A, AB, B and C power amplifier, Class D amplifiers, Class E amplifiers Class F amplifiers, Modulation of power amplifiers, summary of PA characteristics, RF PA design examples, additional design considerations, Design summery.

7 Hours

TEXT BOOK:

1. **The design of CMOS radio-frequency integrated circuit**, Thomas H. Lee, 2nd edition Cambridge, 2004.

REFERENCE BOOK:

1. **Design of Analog CMOS integrated circuit**, Behzad Razavi, Tata Mc Graw Hill, 2005.

WAVELET TRANSFORMS

Subject Code	: **06EC764**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

CONTINUOUS WAVELET TRANSFORM: Introduction, C-T wavelets, Definition of CWT, The CWT as a correlation. Constant Q-Factor Filtering Interpolation and time frequency resolution, the CWT as an operator, inverse CWT.

5 Hours

UNIT - 2

INTRODUCTION TO DISCRETE WAVELET TRANSFORM AND ORTHOGONAL WAVELET DECOMPOSITION: Introduction. Approximation of vectors in nested linear vector spaces, (i) example of approximating vectors in nested subspaces of a finite dimensional liner vector space, (ii) Example of approximating vectors in nested subspaces of an infinite dimensional linear vector space. Example MRA. (i) Bases for the approximations subspaces and Harr scaling function, (ii) Bases for detail subspaces and Haar wavelet.

8 Hours

UNIT - 3

MRA, ORTHO NORMAL WAVELETS AND THEIR RELATIONSHIP TO FILTER BANKS: Introduction, Formal definition of an MRA. Construction of a general orthonormal MRA, (i) scaling function and subspaces, (ii) Implication of dilation equation and orthogonality, a wavelet basis for MRA. (i) Two scale relations for (t), (ii) Basis for the detail subspace (iii) Direct sum decomposition, Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal.

8 Hours

UNIT - 4

EXAMPLES OF WAVELETS: Examples of orthogonal basis generating wavelets, (i) Daubechies D_4 scaling function and wavelet. (ii) band limited wavelets, Interpreting orthonormal MRAs for Discrete time MRA, (iii) Basis functions for DTWT.

5 Hours

PART - B

UNIT - 5

ALTERNATIVE WAVELET REPRESENTATIONS: Introduction, Bi-orthogonal wavelet bases, Filtering relationship for bi-orthogonal filters, Examples of bi-orthogonal scaling functions and wavelets. 2-D wavelets.

8 Hours

UNIT - 6

Non - separable multidimensional wavelets, wavelet packets. Wavelets Transform and Data Compression: Introduction, transform coding, DTWT for image compression (i) Image compression using DTWT and run-length encoding.

6 Hours

UNIT - 7

(i) Embedded tree image coding (ii) compression with JPEG audio compression (iii) Audio masking, (iv) Wavelet based audio coding.

6 Hours

UNIT - 8

CONSTRUCTION OF SIMPLE WAVELETS: Construction of simple wavelets like Harr and DB1. Other Applications of Wavelet Transforms: Introduction, wavelet de-noising, speckle removal, edge detection and object isolation, Image fusions, Object detection by wavelet transforms of projections.

6 Hours

TEXT BOOK:

1. **Wavelet transforms- Introduction to theory and applications**, Raghuveer M.Rao and Ajit S. Bapardikar, Person Education, 2000.

REFERENCE BOOKS:

1. **Wavelet transforms,** Prasad and Iyengar, Wiley estern, 2001.
2. **Wave-let and filter banks**, Gilbert Strang and Nguyen Wellesley Cambridge press, 1996

MODELING AND SIMULATION OF DATA NETWORKS

Subject Code	: **06EC765**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT – 1&2

DELAY MODELS IN DATA NETWORKS: Queuing Models, M/M/1, M/M/m, M/M/∞, M/M/m/m and other Markov System, M/G/1 System, Networks of Transmission Lines, Time Reversibility, Networks of Queues.

14 Hours

UNIT – 3&4

MULTI-ACCESS COMMUNICATION: Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing, Multi-access Reservations, Packet Radio Networks.

12 Hours

PART - B

UNIT – 5&6

ROUTING IN DATA NETWORKS: Introduction, Network Algorithms and Shortest Path Routing, Broadcasting Routing Information: Coping with Link Failures, Flow models, Optimal Routing, and Topological Design, Characterization of Optimal Routing, Feasible Direction Methods for Optimal Routing, Projection Methods for Optimum Routing, Routing in the Codex Network.

14 Hours

UNIT – 7&8

FLOW CONTROL: Introduction, Window Flow Control, Rate Control Schemes, Overview of Flow Control in Practice, Rate Adjustment Algorithms.

12 Hours

REFERENCE BOOKS:

1. **"Data Networks"** Dimitri Bertsekas and Robert Gallager, 2nd edition, Prentice Hall of India, 2003.
2. **"High-Speed Networks and Internets"** William Stallings, Pearson Education (Asia) Pte. Ltd, 2004.
3. **"High Performance Communication Networks"** J. Walrand and P. Varaya, 2nd edition, Harcourt India Pvt. Ltd. & Morgan Kaufman, 2000.

SPEECH PROCESSING

Subject Code	: **06EC766**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

PRODUCTION AND CLASSIFICATION OF SPEECH SOUNDS: Introduction, mechanism of speech production. Acoustic phonetics: vowels, diphthongs, semivowels, nasals, fricatives, stops and affricates.

7 Hours

UNIT - 2

TIME-DOMAIN METHODS FOR SPEECH PROCESSING: time dependent processing of speech, short-time energy and average magnitude, short-time average zero crossing rate.

7 Hours

UNIT - 3

Speech vs. silence detection, pitch period estimation using parallel processing approach, short-time autocorrelation function.

7 Hours

UNIT - 4

Brief Applications of temporal processing of speech signals in synthesis, enhancement, hearing applications and clear speech.

5 Hours

PART - B

UNIT - 5

FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING: Introduction, definitions and properties: Fourier transforms interpretation and linear filter interpretation, sampling rates in time and frequency.

8 Hours

UNIT - 6

Filter bank summation and overlap add methods for short-time synthesis of speech, sinusoidal and harmonic plus noise method of analysis/synthesis.

6 Hours

UNIT - 7

HOMOMORPHIC SPEECH PROCESSING: Introduction, homomorphic system for convolution, the complex cepstrum of speech, homomorphic vocoder.

7 Hours

UNIT - 8

APPLICATIONS OF SPEECH PROCESSING: Brief applications of speech processing in voice response systems hearing aid design and recognition systems.

5 Hours

TEXT BOOK:

1. **Digital Processing of Speech Signals**, L. R. Rabiner and R. W. Schafer, Pearson Education Asia, 2004.

REFERENCE BOOKS:

1. **Discrete Time Speech Signal Processing**, T. F. Quatieri, Pearson Education Asia, 2004.
2. **Speech and Audio Signal Processing: Processing and Perception of Speech and Music**, B. Gold and N. Morgan, John Wiley, 2004.

HUMAN RESOURCE MANAGEMENT

Subject Code	: **06EC767**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART – A

UNIT - 1

Understanding the Nature and Scope of HRM, Context of HRM, Integrating HR Strategy with Business Strategy**.**

8 Hours

UNIT - 2 & 3

Human Resource Planning, Analysing Work and Designing Jobs, Recruiting Human Resources, Selecting Human Resources.

12 Hours

UNIT - 4

Training, Development and Career Management, Appraising and Managing Performance, Managing Basic Remuneration.

6 Hours

PART – B

UNIT - 5

Incentives and Performance based. Payments, Managing Employee benefits and services.

6 Hours

UNIT - 6

Managing Betterment work, Safe and Healthy Environment.

6 Hours

UNIT - 7

Industrial Relations, Trade Unions.

6 Hours

UNIT - 8

Managing Ethical Issues in HRM, Evaluating HRM Effectiveness, Contemporary issues in HRM, International issues in HRM. Case studies to be included in all chapters.

8 Hours

TEXT BOOK:

1. **Human Resource Management**: K. Ashwathappa, Text and Cases. Fifth Edition (2008) Tata McGraw-Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOK:

1. **Human Resource Management,** Gary Dessler, Tenth Edition (Indian subcontinent adaptation 2008), Pearson Education, Inc.

MICRO AND SMART SYSTEMS TECHNOLOGY

Subject Code	:	**06MS769**	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO MICRO AND SMART SYSTEMS:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

b) What are microsystems? Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.

5 Hours

UNIT - 2

MICRO AND SMART DEVICES AND SYSTEMS: PRINCIPLES AND MATERIALS:

a) Definitions and salient features of sensors, actuators, and systems.

b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.

c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print-head, electrostatic comb-drive and micromotor, magnetic micro relay, shape-memory-alloy based actuator, electro-thermal actuator.

d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin.

8 Hours

UNIT - 3

MICROMANUFACTURING AND MATERIAL PROCESSING:

a. Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.
b. Silicon micromachining: surface, bulk, moulding, bonding based process flows.
c. Thick-film processing:
d. Smart material processing:
e. Processing of other materials: ceramics, polymers and metals
f. Emerging trends

7 Hours

UNIT - 4

MODELING:

a. Scaling issues.

b. Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.
c. Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators.

6 Hours

PART - B

UNIT - 5

COMPUTER-AIDED SIMULATION AND DESIGN:

Background to the finite element element method. Coupled-domain simulations using Matlab. Commercial software.

8 Hours

UNIT - 6

ELECTRONICS, CIRCUITS AND CONTROL:

Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from microsystems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micromachined accelerometer or a thermal cycler.

8 Hours

UNIT - 7

INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS:

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low-temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples.

6 Hours

UNIT - 8

CASE STUDIES:

BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam.

4 Hours

PART – C

UNIT - 9

Mini-projects and class-demonstrations (not for Examination)

9 Hours

a) CAD lab (coupled field simulation of electrostatic-elastic actuation with fluid effect)
b) BEL pressure sensor
c) Thermal-cycler for PCR
d) Active control of a cantilever beam

TEXT BOOKS AND A CD-SUPPLEMENT:

1. **MEMS & Microsystems: Design and Manufacture,** Tai-Ran Tsu, Tata Mc-Graw-Hill.

REFERENCE BOOKS:

1. Animations of working principles, process flows and processing techniques, A CD-supplement with Matlab codes, photographs and movie clips of processing machinery and working devices.
2. **Laboratory hardware kits for** (i) BEL pressure sensor, (ii) thermal-cycler and (iii) active control of a cantilever beam.
1. **Microsystems Design,** S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.
2. **Analysis and Design Principles of MEMS Devices,** Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.
3. **Design and Development Methodologies,** Smart Material Systems and MEMS: V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.
4. **MEMS-** Nitaigour Premchand Mahalik, TMH 2007

VIII SEMESTER

WIRELESS COMMUNICATION

Subject Code	: **06EC81**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction to wireless telecommunication systems and Networks, History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks.

6 Hours

UNIT - 2

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.

6 Hours

UNIT - 3

Wireless network architecture and operation, Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security

6 Hours

UNIT - 4

GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers

6 Hours

PART - B

UNIT - 5

GSM system operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems

6 Hours

UNIT - 6

CDMA technology, CDMA overview, CDMA channel concept CDMA operations.

8 Hours

UNIT - 7

Wireless Modulation techniques and Hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware.

6 Hours

UNIT - 8

Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies.

8 Hours

TEXT BOOK:

1. **Wireless Telecom Systems and networks**, Mullet: Thomson Learning 2006.

REFERENCE BOOKS:

1. **Mobile Cellular Telecommunication**, Lee W.C.Y, MGH, 2002.
2. **Wireless communication** - D P Agrawal: 2nd Edition Thomson learning 2007.
3. **Fundamentals of Wireless Communication**, David Tse, Pramod Viswanath, Cambridge 2005.

EMBEDDED SYSTEM DESIGN

Subject Code	: **06EC82**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Overview of embedded systems, embedded system design challenges, common design metrics and optimizing them. Survey of different embedded system design technologies, trade-offs. Custom Single-Purpose Processors, Design of custom single purpose processors.

4 Hours

UNIT - 2

SINGLE-PURPOSE PROCESSORS: Hardware, Combinational Logic, Sequential Logic, RT level Combinational and Sequential Components, Optimizing single-purpose processors. Single-Purpose Processors: Software, Basic Architecture, Operation, Programmer's View, Development Environment, ASIPS.

6 Hours

UNIT - 3

Standard Single-Purpose Peripherals, Timers, Counters, UART, PWM, LCD Controllers, Keypad controllers, Stepper Motor Controller, A to D Converters, Examples.

6 Hours

UNIT - 4

MEMORY: Introduction, Common memory Types, Compulsory memory, Memory Hierarchy and Cache, Advanced RAM. Interfacing, Communication Basics, Microprocessor Interfacing, Arbitration, Advanced Communication Principles, Protocolos - Serial, Parallel and Wireless.

8 Hours

PART - B

UNIT - 5

INTERRUPTS: Basics - Shared Data Problem - Interrupt latency. Survey of Software Architecture, Round Robin, Round Robin with Interrupts - Function Queues - scheduling - RTOS architecture.

8 Hours

UNIT - 6

INTRODUCTION TO RTOS: Tasks - states - Data - Semaphores and shared data. More operating systems services - Massage Queues - Mail Boxes -Timers – Events - Memory Management.

8 Hours

UNIT – 7&8

Basic Design Using RTOS, Principles- An example, Encapsulating semaphores and Queues.

Hard real-time scheduling considerations – Saving Memory space and power. Hardware software co-design aspects in embedded systems.

12 Hours

TEXT BOOKS:

1. **Embedded System Design: A Unified Hardware/Software Introduction** - Frank Vahid, Tony Givargis, John Wiley & Sons, Inc.2002
2. **An Embedded software Primer** - David E. Simon: Pearson Education, 1999

REFERENCE BOOKS:

1. **Embedded Systems: Architecture and Programming,** Raj Kamal, TMH. 2008
2. **Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers**, Tammy Noergaard, Elsevier Publication, 2005
3. **Embedded C programming**, Barnett, Cox & O'cull, Thomson (2005).

ELECTIVE –4 (GROUP D)

DISTRIBUTED SYSTEM

Subject Code	: **06EC831**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

6 Hours

UNIT - 2

SYSTEM MODELS: Introduction, Architectural models, Fundamental mode.

6 Hours

UNIT - 3

INTERPROCESS COMMUNICATION: Introduction, The API for the internet protocols, External data representation and marshalling, Clint-server communication, Group communication.

8 Hours

UNIT - 4

DISTRIBUTED OBJECTS AND REMOTE INVOCATION: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications.

6 Hours

PART - B

UNIT - 5

SECURITY: Introduction, Overview of security technique cryptographic algorithms, Digital signature, Cryptography progrmatics.

7 Hours

UNIT - 6

TIME & GLOBAL STATES: Introduction, Clocks, Events, Process states, Synchronizing physical clocks, Global states, Distributed debugging.

7 Hours

UNIT - 7

COORDINATION AND AGREEMENT: Distributed mutual exclusion, Elections, Multicast communication.

7 Hours

UNIT - 8

CORBA CASE STUDY: Introduction, CORBA RMI, CORBA Services.

5 Hours

TEXT BOOK:

1. **"Distributed Systems, Concepts & Design"**, George Coulouris, Jeam Dollimore, Tim Kindberg, fourth edition, 2006. Pearson education.

REFERENCE BOOK:

1. **"Distributed System Architecture, a Middleware Approach"** Arno puder, Kay Romer, Frank Pilhofer, Morgan Kaufmann publishers.

NETWORK SECURITY

Subject Code	: **06EC832**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

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

3 Hours

UNIT - 2

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

9 Hours

UNIT - 3

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

8 Hours

UNIT - 4

Digital signatures, Authentication Protocols, Digital Signature Standard.

7 Hours

PART - B

UNIT - 5

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

6 Hours

UNIT - 6

Intruders, Intrusion Detection, Password Management.

6 Hours

UNIT - 7

MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Countermeasures.

6 Hours

UNIT - 8

Firewalls Design Principles, Trusted Systems.

7 Hours

TEXT BOOK:

1. **Cryptography and Network Security**, William Stalling, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security**, Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and Network Security**, Atul Kahate, TMH, 2003.

INTERNET ENGINEERING

Subject Code	: **06EC833**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Communication model, Communication software, and communication protocol: Representation, Development methods, Protocol engineering process. NETWORK REFERENCE MODEL**:** Layered architecture, Network services and interfaces, protocol functions, OSI model, TCP/IP protocol suite, Application protocols.

7 Hours

UNIT - 2

PROTOCOL SPECIFICATION: Communication service specification, Protocol entity specification, Interface specifications, Interactions, Multimedia protocol specifications, Internet protocol specifications.

6 Hours

UNIT - 3

SPECIFICATION AND DESCRIPTION LANGUAGE (SDL): A protocol specification language: SDL.

6 Hours

UNIT - 4

Examples of SDL based protocol specifications, Other protocol specification languages. Protocol Verification And Validation, Protocol verification, Verification of a protocol using finite state machines.

6 Hours

PART – B

UNIT - 5

Protocol validation, Protocol design errors, and protocol validation approaches, SDL based protocol verification, SDL based protocol validation.

7 Hours

UNIT - 6

PROTOCOL CONFORMANCE TESTING: Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distribute architecture by local methods, Conformance testing with TTCN, Conformance testing of RIP, Multimedia applications testing, SDL based tools for conformance testing.

7 Hours

UNIT - 7

PROTOCOL PERFORMANCE TESTING: SDL based performance testing of TCP, OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using bridge, Scalability testing.

7 Hours

UNIT - 8

PROTOCOL SYNTHESIS: Synthesis methods, interactive synthesis algorithms, automatic synthesis algorithm, automatic synthesis of SDL from MSC protocol re synthesis.

6 Hours

TEXT BOOK:

1. **Communication Protocol Engineering**, P. Venkatarm and S. S. Manvi, PHI, 2004.

REFERENCES BOOKS:

1. **The Internet and its Protocols**, Adrian Farrel, Elsevier, 2006.
2. **TCP/IP Protocol Stack**, B A Forouzan, TMH, 2006.

BIOMEDICAL SIGNAL PROCESSING

Subject Code	: **06EC834**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION TO BIOMEDICAL SIGNALS: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis.

5 Hours

UNIT - 2

ELECTROCARDIOGRAPHY: Basic electrocardiography, ECG lead systems, ECG signal characteristics.

5 Hours

UNIT - 3

BASICS OF DIGITAL FILTERING: Digital filters, the Z-transform, elements of digital filter, types of digital filters, transfer function of a difference equation, the z-plane pole-zero plot, the rubber membrane concept.

6 Hours

UNIT - 4

ADAPTIVE FILTERS: Principal noise canceler model, 60-Hz adaptive canceling using a sine wave model, other applications of adaptive filtering.

8 Hours

PART - B

UNIT - 5

SIGNAL AVERAGING: Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging.

8 Hours

UNIT - 6

DATA REDUCTION TECHNIQUES: Turning point algorithm, Fan algorithm, Huffman coding.

8 Hours

UNIT - 7

ECG QRS DETECTION: Power spectrum of the ECG, bandpass filtering techniques, differentiation techniques, template matching techniques, a QRS detection algorithm.

6 Hours

UNIT - 8

ECG ANALYSIS SYSTEMS: ECG interpretation, ST-segment analyzer, portable arrhythmia monitor. VLSI in Digital signal Processing: Digital

signal processors, high performance VLSI signal processing, VLSI applications in medicine, VLSI sensors for biomedical signals, VLSI tools, Choice of custom, ASIC, or off-the-shelf components.

6 Hours

TEXT BOOK:

1. **Biomedical Digital Signal Processing** - Willis J. Tompkins, PHI, 2001.

REFERENCE BOOK:

1. **Biomedical Signal Analysis** - Rangaraj M. Rangayyan John Wiley & Sons, Inc., 2002.

HIGH PERFORMANCE COMPUTER NETWORKS

Subject Code	: **06EC835**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

History of Communication Networks, Networking principles, Future networks Internet, Pure TAM Network, Cable Network, Wireless.

6 Hours

UNIT - 2

NETWORK SERVICES AND LAYERED ARCHITECTURE: Applications, Traffic characterization and quality of services, Network services, High performance networks, Network Elements., Layered applications, Open data network model, Network architectures, Network bottlenecks.

7 Hours

UNIT - 3

INTERNET AND TCP/IP NETWORKS: Multicast IP, Mobile IP, TCP and UDP, Applications, FTP, SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched networks.

7 Hours

UNIT - 4

SONET, DWDM, FTH, DSL, Intelligent networks CATV.

6 Hours

PART - B

UNIT - 5

ATM: Main features of ATM, Addressing, signaling and Routing, ATM header structure, ATM AAL, Internetworking with ATM.

7 Hours

UNIT - 6

WIRELESS NETWORKS: Link level design, Channel Access, Network design, Wireless networks today, Future networks, ad hoc networks, High speed Digital cellular, Home RF and Bluetooth.

6 Hours

UNIT - 7

Control of networks, Objectives and methods of control, Circuit switched networks, Datagram Networks Network economics, Derived demand for network services, ISPs, subscriber demand model, Empirical model.

7 Hours

UNIT - 8

OPTICAL NETWORKS: WDM systems, Optical cross connects, Optical LANs, Optical paths and networks.

7 Hours

TEXT BOOK:

1. **High Performance Communication Networks,** Warland and Varaiya: Morgan Kauffman/ Elsivier 2nd Edition 2000.

REFFRENCE BOOKS:

1. **High-Speed Networks and Internet: Performance and Quality of service**, William Stallings, Pearson Edu., 2001.
2. **Building High-Speed Networks**, Tere Parnell, TMGH, 2000.

FUZZY LOGIC

Subject Code	: **06EC836**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Background, Uncertainty and imprecision, Statistics and random processes, Uncertainty in information, Fuzzy sets and membership, Chance versus ambiguity, Classical sets - operations on classical sets to

functions, Fuzzy sets-fuzzy set operations, Properties of fuzzy sets. Sets as points in hypercubes.

7 Hours

UNIT - 2

CLASSICAL RELATIONS AND FUZZY RELATIONS: Cartesian product, Crisp relations-cardinality of crisp relations, Operations on crisp relations, Properties of crisp relations, Compositions, Fuzzy relations-cardinality of fuzzy relations, Operations on fuzzy relations, Properties of fuzzy relations, Fuzzy Cartesian product and composition, Non interactive fuzzy sets, Tolerance and equivalence relations-crisp equivalence relation, Crisp tolerance relation, Fuzzy tolerance, Max-min Method, other similarity methods.

7 Hours

UNIT - 3

MEMBERSHIP FUNCTIONS: Features of the membership function, Standards forms and boundaries, fuzzification, Membership value assignments-intuition, Inference, Rank ordering, Angular fuzzy sets. Neural networks, Genetic algorithms, Inductive reasoning.

6 Hours

UNIT - 4

FUZZY-TO-CRISP CONVERSIONS AND FUZZY ARITHMETIC: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Extension principle-crisp functions, Mapping and relations, Functions of fuzzy sets-extension principle, Fuzzy transform (Mapping), Practical considerations, and Fuzzy numbers Interval analysis in Arithmetic, Approximate methods of extension-vertex method, DSW algorithm, Restricted DSW algorithm, Comparisons, Fuzzy vectors.

6 Hours

PART - B

UNIT - 5

CLASSICAL LOGIC AND FUZZY LOGIC: Classical predicate logic-tautologies, Contradictions, Equivalence, Exclusive or and exclusive nor, Logical proofs, Deductive Inferences, Fuzzy logic, Approximate reasoning, Fuzzy tautologies, Contradictions, Equivalence and logical proofs, Other forms of the implication operation, Other forms of the composition operation.

6 Hours

UNIT - 6

FUZZY RULE-BASED SYSTEMS: Natural language, Linguistic hedges, Rule-based system-canonical rule forms, Decomposition of compound rules, Likelihood and truth qualification, Aggregation of fuzzy rules, Graphical techniques of inference.

6 Hours

UNIT - 7

FUZZY DECISION MAKING: Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multiobjective decision making under fuzzy states and fuzzy actions.

8 Hours

UNIT - 8

FUZZY CLASSIFICATION: Classification by equivalence relations-crisp relations, Fuzzy relations cluster analysis, Cluster validity, c-Means clustering-hard c-Means (HCM), Fuzzy c-Means (FCM), classification metric, Hardening the fuzzy c-Partition, Similarity relations from clustering.

6 Hours

TEXT BOOK:

1. **"Fuzzy logic with Engineering applications"**, Timothy J. Ross, McGraw-Hill, 1997.

REFERENCE BOOK:

1. **Nural networks and fuzzy systems: A dynamical system approach**, B. Kosko, Peasrson Edu. 1991.

ELECTIVE –5 (GROUP E)

MULTIMEDIA COMMUNICATIONS

Subject Code	: **06EC841**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

MULTIMEDIA COMMUNICATIONS: Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS application QoS.

7 Hours

UNIT - 2

MULTIMEDIA INFORMATION REPRESENTATION: Introduction, digital principles, text, images, audio, video.

5 Hours

UNIT - 3

TEXT AND IMAGE COMPRESSION: Introduction, compression principles, text compression, image compression.

7 Hours

UNIT - 4

AUDIO AND VIDEO COMPRESSION: Introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4.

7 Hours

PART - B

UNIT - 5

MULTIMEDIA INFORMATION NETWORKS: Introduction, LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol.

7 Hours

UNIT - 6

THE INTERNET: Introduction, IP Datagrams, Fragmentation, IP Address, ARP and RARP, QoS Support, IPv8.

7 Hours

UNIT - 7

BROADBAND ATM NETWORKS: Introduction, Cell format, Switfh and Protocol Architecture ATM LANs.

6 Hours

UNIT - 8

TRANSPORT PROTOCOL: Introduction, TCP/IP, TCP, UDP, RTP and RTCP.

6 Hours

TEXT BOOK:

1. **Multimedia Communications: Applications, Networks, Protocols and Standards**, Fred Halsall, Pearson Education, Asia, Second Indian reprint 2002.

REFERENCE BOOKS:

1. **Multimedia Information Networking**, Nalin K. Sharda, PHI, 2003.
2. **"Multimedia Fundamentals: Vol 1 - Media Coding and Content Processing"**, Ralf Steinmetz, Klara Narstedt, Pearson Education, 2004.
3. **"Multimedia Systems Design"**, Prabhat K. Andleigh, Kiran Thakrar, PHI, 2004.

REAL TIME OPERATING SYSTEMS

Subject Code	: **06EC842**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

DEFINITION AND CLASSIFICATION OF REAL TIME SYSTEMS: Concept of computer control, sequence, loop and supervisor control, centralized, hierarchical and distributed systems, Human Computer interface, hardware requirement for real time applications, specialized processors, interfaces, communications.

6 Hours

UNIT - 2

Special features of languages for real time application, review of data types, concurrency, exception handling, corountines, low-level facilities. Overview of Real time languages, modula 2 and Ada as a Real Time Languages.

6 Hours

UNIT - 3

REAL TIME OPERATING SYSTEMS: (PSOS+V_x WORKS). Scheduling strategies, priority structures, Task management, Real Time Clock Handler, Code sharing, Resource Control, Inter task Communication and Control, Example of Creating and RTOS based on modula 2 kernel; Practical Real Time Operating Systems.

10 Hours

UNIT - 4

Introduction to Design of Real Time Systems, Specification, Preliminary Design, multitasking Approach, monitors, Rendezvous.

5 Hours

PART - B

UNIT - 5

DEVELOPMENT METHODOLOGIES: Yourdon, Methodology, Ward and Mellor Method, HATLEY & Pribhai method, MASXOT, PAISLEY System.

4 Hours

UNIT - 6

DESIGN ANALYSIS: Introduction, Petrinets, Analysis of Petri Nets, Scheduling problem Real Time Database, Real Time Vs General Purpose Databases, Transaction priorities and Aborts, Concurrency Control, Disk Scheduling Algorithms, Maintaining Serialization Consistency.

10 Hours

UNIT - 7

FAULT TOLERANCE TECHNIQUES: Introduction, Faults, Errors and Failures, Fault types, Detection and Containment, Redundancy, Integrated Failure Handling.

6 Hours

UNIT - 8

RELIABILITY EVALUATION: Introduction, Parameters, Reliability Models for Hardware, Software Error Models.

5 Hours

TEXT BOOK:

1. **Real Time Systems**, C. M. Krishna, Kang. G. Shin, Mc Graw Hill, India, 1997.

REFERENCE BOOKS:

1. **Embedded Systems**, Raj Kamal, Tata Mc Graw Hill, India, 2008.
2. **Real-Time Systems Design and Analysis**, Phillip. A. Laplante, second edition, PHI, 2005.
3. **Real Time Systems**, Jane. W. S. Liu, Pearson education, 2005.

OPTICAL NETWORKS

Subject Code	: **06EC843**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION TO OPTICAL NETWORKS: Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, System and network evolution. Non linear effects SPM, CPM, four wave mixing, Solitons.

6 Hours

UNIT - 2

COMPONENTS: Couplers, isolators and Circulators, Multiplexes and filters Optical amplifiers.

7 Hours

UNIT - 3

Transmitters, detectors, Switches, Wavelength converters.

7 Hours

UNIT - 4

TRANSMISSION SYSTEM ENGINEERING: System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration.

6 Hours

PART - B

UNIT - 5

FIRST GENERATION NETWORKS: SONET/SDH, Computer interconnects, Mans, Layered architecture for SONET and second generation networks.

5 Hours

UNIT - 6

WAVELENGTH ROUTING NETWORKS: Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations.

7 Hours

UNIT - 7

VIRTUAL TOPOLOGY DESIGN: Virtual topology design problem, Combines SONET/WDM network design, an ILP formulation, Regular virtual topologies, Control and management, Network management configuration management, Performance management, fault management.

7 Hours

UNIT - 8

ACCESS NETWORKS: Network architecture overview, present and future access networks, HFC, FTTC, Optical access networks Deployment considerations, Photonic packet switching, OTDM, Multiplexing and demultiplexing Synchronisation.

7 Hours

TEXT BOOK:

1. **Optical networks: A practical perspective** Kumar Sivarajan and Rajiv Ramaswamy: Morgan Kauffman 1998.

REFERENCE BOOKS:

1. **Optical Communication Networks**: Biswajit Mukherjee: TMG 1998.
2. **Optical Networks**, Ulysees Black: Pearson education 2007.

GSM

Subject Code	: **06EC844**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

GSM ARCHITECTURE AND INTERFACES: Introduction, GSM frequency bands, GSM PLMN, Objectives of a GSM PLMN, GSM PLMN Services, GSM Subsystems, GSM Subsystems entities, GSM interfaces, The radio interface (MS to BSC), A_{bits} interface (BTS to BSC), A interface (BSC to MSC), Interfaces between other GSM entities, Mapping of GSM layers onto OSI layers.

5 Hours

UNIT - 2

RADIO LINK FEATURES IN GSM SYSTEMS: Introduction, Radio link measurements, Radio link features of GSM, Dynamic power control, Discontinuous transmission (DTX), SFH, Future techniques to reduce interface in GSM, Channel borrowing, Smart antenna.

5 Hours

UNIT - 3

GSM LOGICAL CHANNELS AND FRAME STRUCTURE: Introduction, GSM logical channels, Allowed logical channel combinations, TCH multi frame for TCH/H, CCH multi frame, GSM frame structure, GSM bursts, Normal burst, Synchronization burst, Frequency correction channel burst, Access burst, Data encryption in GSM, Mobility management, Location registration, Mobile identification.

6 Hours

UNIT - 4

SPEECH CODING IN GSM: Introduction, Speech coding methods, Speech code attributes, Transmission bit rate, Delay, Complexity, Quality, LPAS, ITU-T standards, Bit rate, Waveform coding, Time domain waveform coding, Frequency domain waveform coding, Vocoders, Full-rate vocoder, Half-rate vocoder. MESSAGES, SERVICES, AND CALL FLOWS IN GSM: Introduction, GSM PLMN services.

8 Hours

PART - B

UNIT - 5

GSM messages, MS-BS interface, BS to MSC messages on the A interface, MSC to VLR and HLR, GSM call setup by an MS, Mobile-Terminated call, Call release, Handover. Data services, Introduction, Data interworking, GSM data services, Interconnection for switched data, Group 3 fax, Packet data on the signaling channel, User-to-user signaling, SMS, GSM GPRS.

7 Hours

UNIT - 6

PRIVACY AND SECURITY IN GSM: Introduction, Wireless security requirements, Privacy of communications, Authentication requirements, System lifetime requirements, Physical requirements, SIM cards, Security algorithms for GSM, Token-based authentication, Token-based registration, Token-based challenge.

5 Hours

UNIT - 7

PLANNING AND DESIGN OF A GSM WIRELESS NETWORK: Introduction, Tele traffic models, Call model, Topology model, Mobility in cellular / PCS networks, Application of a fluid flow model, Planning of a wireless network, Radio design for a cellular / PCS network, Radio link design, Coverage planning, Design of a wireless system, Service requirements, Constraints for hardware implementation, Propagation path loss, System requirements, Spectral efficiency of a wireless system, Receiver sensitivity and link budget, Selection of modulation scheme, Design of TDMA frame, Relationship between delay spread and symbol rate, Design example for a GSM system.

8 Hours

UNIT - 8

MANAGEMENT OF GSM NETWORKS: Introduction, Traditional approaches to NM, TMN, TMN layers, TMN nodes, TMN interface, TMN management services, Management requirements for wireless networks, Management of radio resources, Personal mobility management, Terminal mobility, Service mobility management, Platform-centered management, SNMP, OSI systems management, NM interface and functionality, NMS functionality, OMC functionality, Management of GSM network, TMN applications, GSM information model, GSM containment tree, Future work items.

8 Hours

TEXT BOOK:

1. **"Principles of Applications of GSM"**, Vijay K. Garg & Joseph E. Wilkes, Pearson education/ PHI, 1999.

REFERENCE BOOKS:

1. **GSM: Evolution towards 3rd Generation Systems**, (Editor), Z. Zvonar Peter Jung, Karl Kammerlander Springer; 1st edition 1998
2. **GSM & UMTS: The Creation of Global Mobile Communication,** Friedhelm Hillebrand, John Wiley & Sons; 2001.

ADHOC WIRELESS NETWORKS

Subject Code	: **06EC845**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART – A

UNIT - 1

AD HOC NETWORKS: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

6 Hours

UNIT - 2

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.

7 Hours

UNIT - 3

Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

6 Hours

UNIT - 4

ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

7 Hours

PART - B

UNIT - 5

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

6 Hours

UNIT - 6

TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a transport layer protocol

for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

7 Hours

UNIT - 7

SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

6 Hours

UNIT - 8

QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

7 Hours

TEXT BOOK:

1. **"Ad hoc wireless Networks"**, C. Siva Ram Murthy & B. S. Manoj, Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS:

1. **"Ad hoc wireless Networks"**, Ozan K. Tonguz and Gianguigi Ferrari, Wiley
2. **"Ad hoc wireless Networking"**, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers.

OPTICAL COMPUTING

Subject Code	: **06EC846**	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1

MATHEMATICAL AND DIGITAL IMAGE FUNDAMENTALS: Introduction, Fourier Transform, discrete Fourier transform, basic diffraction theory, Fourier transform property of lens , sampling and quantization, image enhancement, image restoration.

6 Hours

UNIT - 2

LINER OPTICAL PROCESSING: Introduction, photographic film, spatial filtering using binary filters, holography, inverse filtering, Deblurring.

6 Hours

UNIT - 3

ANALOG OPTICAL ARITHMETIC: Introduction, Halftone processing, nonlinear optical processing, Arithmetic operations.

6 Hours

UNIT - 4

RECOGNITION USING ANALOG OPTICAL SYSTEMS: Introduction, Matched filter, Joint transform correlation, Phase-only filter, Amplitude modulated recognition filters, Generalized correlation filter, Melllin transform based correlation.

8 Hours

PART - B

UNIT - 5

DIGITAL OPTICAL COMPUTING DEVICES: Introduction, Nonlinear devices, Integrated optics, Threshold devices, Spatial high modulators, Theta modulation devices.

6 Hours

UNIT - 6

SHADOW-CASTING AND SYMBOLIC SUBSTITUTION: Introduction, Shadow casting system and design algorithm, POSC logic operations, POSC multiprocessor, Parallel ALU using POSC, Sequential ALU using POSC, POSC image processing, Symbolic substitutions, Optical implementation of symbolic substitution, Limitations and challenges.

7 Hours

UNIT - 7

OPTICAL MATRIX PROCESSING: Introduction, Multiplication, Multiplication using convolution, Matrix operations, Cellular logic architecture, Programmable logic array.

6 Hours

UNIT - 8

ARTIFICIAL INTELLIGENT COMPUTATIONS: Introduction, Neural networks, Associative memory, Optical implementations, Interconnections, Artificial Intelligence.

7 Hours

TEXT BOOK:

1. **"Optical Computing An Introduction"**, Mohammed A. Karim, John Wiley & Sons, 1992.

REFERENCE BOOKS:

1. **Optical Signal Processing** by Vanderlugnt John willy & sons NY 1992.
2. **Signal Processing in Optics** - Bradly G Boore Oxford University Press 1998.