EC-501 SIGNALS AND SYSTEMS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INTRODUCTION	**Lectures Required:7** Continuous time and discrete time systems, Properties of systems. Linear time invariant systems - continuous time and discrete time. Properties of LTI systems and their block diagrams. Convolution, Discrete time systems described by difference equations.
II	FOURIER SERIES REPRESENTATION OF SIGNALS	**Lectures Required:7** Fourier series representation of continuous periodic signal & its properties, Fourier series representation of Discrete periodic signal & its properties, Continuous time filters & Discrete time filters described by Diff. equation.
III	FOURIER TRANSFORM	**Lectures Required:7** The continuous time Fourier transform for periodic and aperiodic signals, Properties of CTFT. Discrete time Fourier transform for periodic and aperiodic signals. Properties of DTFT. The convolution and modulation property.
IV	Z-TRANSFORM & LAPLACE TRANSFORM	**Lectures Required:7** Introduction. The region of convergence for the Z-transform. The Inverse Z-transform. Two dimensional Z-transform. Properties of Z transform. Laplace transform, Properties of Laplace Transform, Application of Laplace transform to system analysis.
V	SAMPLING	**Lectures Required:7** Mathematical theory of sampling. Sampling theorem. Ideal & Real sampling. Interpolation technique for the reconstruction of a signal from its samples. Aliasing. Sampling in freq. domain. Sampling of discrete time signals.

EC-502 LINEAR INTEGRATED CIRCUITS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-0 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	OPERATIONAL AMPLIFIERS	**Lectures Required:7** Basic differential amplifier analysis, Single ended and double ended configurations ,Op-amp configurations with feedback, Op-amp parameters, Inverting and Non- Inverting configuration, Comparators, Adder.
II	OPERATIONAL AMPLIFIER APPLICATIONS	**Lectures Required:7** Integrator, Differentiator, Voltage to frequency & Frequency to voltage converters. Oscillators: Phase shift, Wien bridge, Quadrature, square wave, triangular wave, sawtooth oscillators. Voltage controlled oscillators
III	ACTIVE FILTERS	**Lectures Required:7** Low pass, high pass, band pass and band reject filters,All pass filter, Switched capacitor filter, Butterworth filter design, Chebyshev Filter design.
IV	PHASE-LOCKED LOOPS	**Lectures Required:7** Operating Principles of PLL, Linear Model of PLL, Lock range, Capture range, Applications of PLL as FM detector, FSK demodulator, AM detector, frequency translator, phase shifter, tracking filter, signal synchronizer and frequency synthesizer, Building blocks of PLL, LM 565 PLL.
V	LINEAR IC's	**Lectures Required:7** Four quadrant multiplier & its applications, Basic blocks of linear IC voltage regulators, Three terminal voltage regulators, Positive and negative voltage regulators. The 555 timer as astable and monostable multivibrators. Zero crossing detector, Schmitt trigger

EC - 503 TELECOMMUNICATION ENGINEERING

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	TRANSMISSION LINE	**Lectures Required:7** Types of transmission lines, general transmission line equation, line constant, equivalent circuits, infinite line, and reflection on a line, SWR of line with different type of terminations. Distortion less and dissipation less lines, Coaxial cables, Transmission lines at audio and radio frequencies, Losses in transmission line,. Characteristics of quarter wave, half wave and lines of other lengths,
II	TRANSMISSION LINE APPLICATIONS	**Lectures Required:7** Smith chart and its application. Transmission line applications, Impedance matching Network. Single & double Stub matching. Measurement of parameters of transmission line, measurement of attenuation, insertion loss, reflection coefficient and standing wave ratio.
III	ATTENUATORS & FILTERS	**Lectures Required:7** Elements of telephone transmission networks, symmetrical and Asymmetrical two port networks. Different Attenuators, p-section & T-section attenuators, stub matching, Transmission equalizers Filters, constant K-section, Ladder type, p-section, T-section filter, m-derived
IV	TELEPHONE TRANSMISSION	**Lectures Required:7** Telephone set, Touch tone dial types, two wire/ four wire transmission, Echo suppressors & cancellors, cross talk. Multi-channel systems: Frequency division & time division multiplexing.
V	AUTOMATIC TELEPHONY & TELEGRAPHY	**Lectures Required:7** Trunking concepts, Grade of service, Traffic definitions, Introduction to switching networks, classification of switching systems. Principle of Electronic Exchange, EPABX and SPC Digital telephone Exchange,Numberig Plan, Fascimile services.

EC - 504 ANALOG COMMUNICATION THEORY

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	NOISE EFFECTS IN COMMUNICATION SYSTEMS	**Lectures Required:7** Resistor noise, Networks with reactive elements, Noise temperature, Noise bandwidth, effective input noise temperature, Noise figure. Noise figure & equivalent noise temperature in cascaded circuits.
II	AMPLITUDE MODULATION	**Lectures Required:8** Frequency translation, Recovery of base band signal, Spectrum & power relations in AM systems. Methods of generation & demodulation of AM-DSB, AM-DSB/SC and AM-SSB signals. Modulation & detector circuits for AM systems. AM transmitters & receivers.
III	FREQUENCY MODULATION	**Lectures Required:7** Phase & freq. modulation & their relationship, Spectrum & band width of a sinusoidally modulated FM signal, phasor diagram, Narrow band & wide band FM. Generation & demodulation of FM signals. FM transmitters & receivers.. Comparison of AM, FM & PM. Pre emphasis & de-emphasis. Threshold in FM, PLL demodulator.
IV	NOISE IN AM AND FM	**Lectures Required:7** Calculation of signal-to-noise ratio in SSB-SC, DSB-SC, DSB with carrier, Noise calculation of square law demodulator & envelope detector. Calculation of *SIN r*atio in FM demodulators.
V	PULSE ANALOG MODULATION	**Lectures Required:6** Practical aspects of sampling: Natural and flat top sampling. PAM, PWM, PPM modulation and demodulation methods, PAM-TDM

Recommended Books:

1. H. Taub & D.L. Schilling- "Principles of Communication Systems" Tata Mc-Graw Hill.
2. G.Kennedy-"Electronic Communication Systems", Tata Mc-Graw Hill.
3. Simon Haykin- "Communication Systems", John Wiley & Sons.
4. B.P. Lathi-"Communication Systems", John Wiley
5. B.P. Lathi-Modern Digital Analog communication Systems.
6. Louch- Digital & Analog communication, Pearson Education.
7. Tomasi-Electronic Communication, Pearson Education

EC - 505 MICROWAVE ENGINEERING-I

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**WAVE GUIDES**	**Lectures Required:8** Introduction of Microwaves and their applications. Rectangular Waveguides , Solution of Wave equation in TE and TM modes. Power transmission and Power losses. Excitation of modes in Rectangular waveguides, circular waveguides : Basic idea of TE and TM modes, field patterns, TEM mode of propagation.
II	**WAVEGUIDE COMPONENTS**	**Lectures Required:7** Scattering matrix representation of networks. Rectangular cavity and circular cavity resonators. Waveguide Tees, Magic Tees. Hybrid rings. Waveguide corners, Bends and twists. Directional couplers, Circulators and isolators.
III	**KLYSTRONS**	**Lectures Required:8** Limitation of conventional vacuum tubes, Construction and operation of two cavity & multicavity klystrons. Velocity modulation and electron bunching (analytical treatment), Applegate diagram and applications of two cavity klystrons. Construction, working and operation of Reflex klystron. Applications and practical considerations. Velocity modulation, power output and frequency characteristics of a Reflex klystron. Electron admittance.
IV	**TRAVELLING WAVE TUBES (TWT)**	**Lectures Required:6** Construction, operation and practical consideration of helix type TWT. Introduction to CW power, pulsed dual mode TWT. Coupled cavity TWT. Applications of TWT.
V	**MAGNETRON**	**Lectures Required:6** Types of Magnetron. Construction, operation, analysis and practical consideration of cavity or travelling wave magnetron. Introduction to coaxial, frequency angle and voltage tunable magnetrons. Backward cross field oscillator, Forward wave cross field amplifier.

Suggested Books:

1. Liao "Microwave devices & Circuits"
2. Kulkarni "Microwave & Radar Engg."
3. Susodia & Susodia

EC 506.1 BIOMEDICAL INSTRUMENTATION

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**HUMAN BODY SUBSYSTEMS**	Brief description of neural, muscular, cardiovascular and respiratory systems; their electrical, mechanical and chemical activities. **TRANSDUCERS AND ELECTRODES**: Principles and classification of transducers for Bio-medical applications, Electrode theory, different types of electrodes, Selection criteria for transducers and electrodes.
II	**BIOPOTENTIALS**	Electrical activity of excitable cells, ENG, EMG, ECG, ERG, EEG. Neuron potential. **CARDIOVASCULAR SYSTEM MEASUREMENTS**: Measurement of blood pressure, blood flow, cardiac output, cardiac rate, heart sounds, Electrocardiograph, phonocardiograph, Plethysmograph, Echocardiograph.
III	**INSTRUMENTATION FOR CLINICAL LABORATORY**	Measurement of pH valve of blood, ESR measurement, hemoglobin measurement, O2 and CO2 concentration in blood, GSR measurement. Instrumentation for clinical laboratory: Spectrophotometry, chromatography, Hematology, Measurement of pH value, concentration in blood. **MEDICAL IMAGING**: Diagnostic X-rays, CAT, MRI, thermography, Ultrasonography, medical use of isotopes, endoscopy.
IV	**PATIENT CARE, MONITORING AND SAFETY MEASURES**	Elements of Intensive care monitoring basic hospital systems and components, physiological effect of electric current shock hazards from electrical equipment, safety measures, Standards & practices. **COMPUTER APPLICATIONS AND BIOTELEMETRY**: Real time computer applications, data acquisition and processing, remote data recording and management.
V	**THERAPEUTIC AND PROSTHETIC DEVICES**	Introduction to cardiac pacemakers, defibrillators, ventilators, muscle stimulators, diathermy, heart lung machine, Hemodialysis, Applications of Laser.

EC 506.2 INTELLECTUAL PROPERTY RIGHT

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	BASIC CONCEPTS OF INTELLECTUAL PROPERTY:	**Lectures Required:** Introduction to intellectual property rights, Intellectual property laws and the Internet, Trade Related Aspects of Intellectual Property Rights
II	PATENTS:	**Lectures Required:** Introduction to patent law and conditions for patentability, Procedure for obtaining patents, Rights of a patentee, Patent infringements, Biotechnology patents and patents on computer programs, Patents from an international perspective
III	TRADEMARK AND GEOGRAPHICAL INDICATIONS:	**Lectures Required:** Statutory authorities and registration procedure, Rights conferred by registration, Licensing, assignment and transfer of trademark rights, Trademark infringement, Geographical Indication of Goods & Appellations of Origin
IV	COPYRIGHT:	**Lectures Required:** Registration procedure and copyright authorities, Assignment and transfer of copyright, Copyright infringement and exceptions to infringement, Software copyright
V	DESIGNS:	**Lectures Required:** Introduction to the law on Industrial Designs, Registration and piracy, International perspective, Introduction to the law on semiconductor layout design, Registration, commercial exploitation and infringement

EC 506.3 ADVANCED DATA STRUCTURES

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	ADVANCED TREES	**Lectures Required:8** Definitions and operations on weight balanced trees (Huffman trees), 2-3 trees and Red-Black trees. Augmenting Red-Black trees to cynamic order statistics and interval tree applications. Operations on disjoInt sets and its Union-Find problem. Implementing sets, discitionerics, priority queues and concatenable queues using 2-3 trees.
II	MERGEABLE HEAPS	**Lectures Required:7** Mergeable Heap operations, binomial trees, implementing binomial heaps and its operations. 2-3-4- trees and 2-3-4 heaps. Structure and potential function of Fibonacci heap. Implementing Fibonacci Heap.
III	GRAPH THEORY DEFINITIONS	**Lectures Required:7** Definitions of Isomorphism, Components, Circuits, Fundamental Circuits, Cut-sets, Cut-Vertices, Planer and dual graphs, Spanning trees, Kuratovski's two graphs.
IV	GRAPH THEORETIC ALGORETHMS	**Lectures Required:7** Algorithms for connectedness, finding all spanning trees in a weighted graph and planarity testing. Breadth first and depth first search, topological sort, strongly connected components and, articulation point.
V	APPLICATION OF GRAPHS	**Lectures Required:6** Single source shortest path and all pair shortest path algorithms. Min-Cut Max-Flow theorem of network flows, Ford-Fulkerson Max Flow algorithms.

EC-507 SIGNAL PROCESSING LAB

Teaching Hours **Exam. Hrs. – Practical**
P - 2 **Marks Practical Exam - 30 Sessional – 45 Total 75**

LIST OF EXPERIMENT

Simulation in MATLAB Environment:

1. Generation of continuous and discrete elementary signals (periodic and non-periodic) using mathematical expression.
2. Generation of Continuous and Discrete Unit Step Signal.
3. Generation of Exponential and Ramp signals in Continuous & Discrete domain.
4. Continuous and discrete time Convolution (using basic definition).
5. Adding and subtracting two given signals. (Continuous as well as Discrete signals)
6. To generate uniform random numbers between (0, 1).
7. To generate a random binary wave.
8. To generate random sequences with arbitrary distributions, means and variances for following :
   (a) Rayleigh distribution
   (b) Normal distributions: N(0,1).
9. To plot the probability density functions. Find mean and variance for the above distributions

EC-508 COMMUNICATION LAB

Teaching Hours **Exam. Hrs. – Practical**
P - 3 **Marks Practical Exam - 40 Sessional – 60 Total 100**

LIST OF EXPERIMENT

1. Observe the Amplitude modulated wave form & measure modulation index.
2. Demodulation of AM signal.
3. Generation & Demodulation of DSB - SC signal.
4. Modulate a sinusoidal signal with high frequency carrier to obtain FM signal
5. Demodulation of the FM signal.
6. To observe the following in a transmission line demonstrator kit:
   (a) The propagation of pulse in non reflecting transmission line.
   (b) The effect of losses in transmission line.
   (c) Transmission with standing waves on a Transmission line.
   (d) The resonance characteristics of a half-wave length long X-mission line.
7. To observe pulse modulation; the operation of sampling and sample & hold circuits.
8. To study the effect of sampling time (sampling pulse width)
9. To study the effects of changing the sampling frequency & observing aliasing phenomena.
10. To study & observe the operation of a super heterodyne receiver (SHR)
11. To study & observe the amplitude response of automatic gain controller (AGC) in SHR.
12. PAM, PWM & PPM: Modulation and demodulation.

EC-509 MICROWAVE ENGINEERING LAB

Teaching Hours **Exam. Hrs. – Practical**
P - 3 **Marks Practical Exam - 40 Sessional – 60 Total 100**

LIST OF EXPERIMENT

1. Study of various microwave components and instruments like frequency meter, attenuator, detector & VSWR meter.
2. Draw V-I characteristics of microwave source like Gunn diode! Reflex Klystron.
3. Measurement of frequency and wavelength in a rectangular waveguide.
4. Measurement of VSWR (small as well as large values) & reflection coefficient.
5. Measure an unknown impedance with smith chart.
6. Draw the following characteristics of Gunn Diode
   (i) Output power and frequency as a function of voltage
   (ii) Square wave modulation by PIN diode.
7. Drawing polar pattern of Horn antenna.
8. To observe the action of directional coupler and its use in separating incident & reflected wave.
9. Study of Magic Tee, Circulator, Isolator
10. Study of spectrum analyzer & its use in observing the response of
    (i) High frequency amplifier
    (ii) Low pass, high pass, band pass, band reject filters.

EC -510 ELECTRONIC ENGINEERING DESIGN LAB

Teaching Hours **Exam. Hrs. – Practical**
P - 3 **Marks Practical Exam - 35 Sessional – 45 Total 175**

LIST OF EXPERIMENT

To design the following circuits, assemble these on bread board and test them.
Simulation of these circuits with the help of appropriate software.

1. Op-Amp characteristics and get data for input bias current, measure the output-offset voltage and reduce it to zero and calculate slew rate.
2. Op-Amp in inverting and non-inverting modes.
3. Op-Amp as differentiator and integrator.
5. Design LPF and HPF using Op-Amp 741
6. Design Band Pass and Band reject Active filters using Op-Amp 741.
7. Design Oscillators using Op-Amp (i) RC phase shift (ii) Hartley (iii) Colpitts
8. Design (i) Astable (ii) Monostable (iii) Bistable multivibrators using IC-555 timer
9. Design Triangular & square wave generator using 555 timer.

EC601-MICROWAVE ENGINEERING-II

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	MICROWAVE MEASUREMENTS	**Lectures Required:7** Detection of microwaves, Microwave power measurement, Impedance measurement, Measurement of scattering parameters, Frequency measurement, VSWR measurements.
II		**Lectures Required:7** Introduction to microstrip lines, Parallel striplines, Coplanar striplines, Shielded striplines, Slot lines, Integrated Fin line, Non-radiative guide, Transitions, Bends and Discontinuities.
III	MICROWAVE NETWORK ANALYSIS	**Lectures Required:7** Impedance and Admittance matrices, Scattering matrix, Reciprocal networks and Loss less networks parameters, ABCD Matrix, Equivalent circuits for Two port Network, Conversions between two port network Signal flow graphs, Discontinuities in waveguides and microstrip.
IV	MICROWAVE SEMICONDUCTOR DEVICES	**Lectures Required:7** Construction, Operation and Practical applications of PIN diode, varactor and Tunnel diode, Gunn diode, IMPATT, TRAPTT diodes, BJT, JFET, MESFET, CCD, MASER and LASER.
V	MONOLITHIC MICOWAVE INTEGRATED CIRCUITS	**Lectures Required:7** Introduction, Materials, MMIC Growth, MOSFET fabrication, Thin film formation, Hybrid integrated circuit fabrication, Advantages & Difficulties of MICs.

EC 602- ADVANCE D MICROPROCESSOR

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INTRODUCTION	**Lectures Required:7** Introduction, compassion of deferent microprocessor, How microprocessor works, ROM & RAM. Conventional & unconventional architecture SISD, SIMD, MIMD & MISD. Microprocessor trends.
II	8086/88 MICROPROCESSOR ARCHITETURE	**Lectures Required:7** 16 bit UPS, PINOOT of 8086/88 bring description. Minimum & maximum mode 8288 bus controller. Address & data bus (AD_0 to AD_{15}) & address/status signals. Architecture9of 8086/88 bring description. Pipelining. Registers of 8086 & memory segmentation.
III	8086 MICROPROCESSOR INSTRUCTION	**Lectures Required:7** Instruction set of 8086 classification & their addressing modes. Clock generator for 8086. instruction format of 8086 courting assembly language program in 8086.
IV	8086 MICROPROCESSOR INTERRUPTS	**Lectures Required:7** Interrupts of 8086. interrupt vector table assembler directives. Stack & subroutine functional block diagram of 80186, 80286 & devise deception
V	INTRODUCTION TO 8086 SERIES	**Lectures Required:7** 30 bit UPS 80386, 80486 functional block diagram. Their registers. Bus operation of 80386 comparison of 80386 & 80486. instructions of 80386 & 80486. instruction to Pentium series. General features & architecture of 8051.Memory, timers and interrupts. Pin details

Reference Books:

1. Douglus Hall.
2. A.K. Ray Bhurchandi
3. B.P. Singh Renu Singh

EC 603- INDUSTRIAL ELECTRONICS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	SEMICONDUCTOR POWER DEVICES	**Lectures Required:7** Basic characteristics & working of Power Diodes, Diac, SCR, Triac, Power Transistor, MOSFETs, IGBT, and GTO.
II	RECTIFIERS & INVERTERS	**Lectures Required:7** Working principles of single and three phase bridge rectifiers, Voltage and current source inverters.
III	POWER SUPPLIES	**Lectures Required:7** Principle of operation of choppers. Step up, Step down and reversible choppers. High frequency electronic ballast, Switch Mode Power Supply: Fly back converter, forward/buck converter, Boost converter and buck-boost converter. Uninterruptible Power Supply.
IV	MOTOR CONTROL	**Lectures Required:7** Introduction to speed control of DC motors using phase controlled converters and choppers, Basic idea of speed control of three phase induction motors using voltage and frequency control methods.
V	STEPPER MOTORS	**Lectures Required:7** Variable reluctance, Permanent magnet and hybrid stepper motors. Induction and dielectric heating control.

EC 604 - DIGITAL COMMUNICATION

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	PCM & DELTA MODULATION SYSTEMS	**Lectures Required:7** PCM and delta modulation, Quantization noise in PCM and delta modulation. Signal-to-noise ratio in PCM and delta modulation, Adaptive delta. Modulation. Bit, word and frame synchronization, T1 Carrier System, Matched filter detection. Error probability in PCM system.
II	BASE BAND TRANSMISSION	**Lectures Required:7** Line coding(RZ,NRZ): Polar,Bipolar,Manchester,AMI. Inter symbol interference, Pulse shaping, Nyquist criterion, Raised cosine spectrum
III	DIGITAL MODULATION TECHNIQUES	**Lectures Required:7** Geometric interpretation of signals,Orthogonalization. ASK, BPSK, BFSK, QPSK, MSK modulation techniques and Coherent detection of these techniques. Calculation of error probabilities.
IV	INFORMATION THEORY	**Lectures Required:7** Amount of Information, Average Information, Entropy, Information rate, Increase in Average information per bit by coding, Shannon's Theorem and Shannon's bound, Capacity of a Gaussian Channel, BW-S/N trade off,
V	CODING	**Lectures Required:7** Coding and decoding of Information, Hamming code, Single Parity-Bit Code, Linear Block code, cyclic code & convolution code.

EC605 CONTROL SYSTEMS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	CONTROL SYSTEMS ANALYSIS AND COMPONENTS	**Lectures Required:7** Examples and application of open loop and close loop systems. Brief idea of multivariable control system, Brief idea of Z-transform and digital control systems. Differential equations. Determination of transfer function by block diagram reduction technique & signal flow graph method.
II	TIME RESPONSE ANALYSIS OF FIRST ORDER & SECOND ORDER SYSTEMS	**Lectures Required:7** Transient response analysis. Steady state error & error constants. Dynamic error and dynamic error coefficient, Performance Indices.
III	FREQUENCY DOMAIN METHODS	**Lectures Required:7** Bode plot, Design specification in frequency domain and their co-relation with time domain.
IV	STABILITY OF THE SYSTEM	**Lectures Required:7** Absolute stability and relative stability. Routh's stability criterion, Hurwitz criterion. Root locus method of analysis. Polar plots, Nyquist stability criterion. M and N loci, Nicholas charts.
V	STATE VARIABLE ANALYSIS	**Lectures Required:7** Concepts of state, state variable and state model. State models for linear continuous time systems. Brief idea of state variable analysis in discrete time domain. Transfer functions, Solution of state equation. Concepts of controllability & observability.

EC606.1 NEURAL NETWORKS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T- **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INTRODUCTION	**Lectures Required:7** Introduction to Neural Networks, Biological basis for NN, Human brain, Models of a Neuron, Directed Graphs, Feedback, Network architectures, Knowledge representation, Artificial intelligence & Neural Networks.
II	LEARNING PROCESSES	**Lectures Required:7** Introduction, Error -Correction learning, Memory -based learning, Hebbian learning, Competitive learning, Boltzmann learning, Learning with a Teacher & without a teacher, learning tasks, Memory, Adaptation.
III	SINGLE LAYER PERCEPTRONS	**Lectures Required:7** Introduction, Least-mean-square algorithm, Learning Curves, Learning rate Annealing Techniques, Perceptron, Perceptron Convergence Theorem.
IV	MULTI LAYER PERCEPTRONS	**Lectures Required:7** Introduction, Back-Propagation Algorithm, XOR Problem, Output representation and Decision rule, Feature Detection, Back-Propagation and Differentiation, Hessian Matrix, Generalization.
V	RADIAL-BASIS FUNCTION NETWORKS & SELF-ORGAN ISING MAPS	**Lectures Required:7** Introduction to Radial basis function networks, Cover's Theorem on the Separability of Patterns, Interpolation Problem, Generalized Radial-Basis function networks, XOR Problem. Self-Organizing map, Summary of SOM Algorithm, Properties of the feature map.

EC 606.2 PARALLEL COMPUTATION & ARCHITECTURE

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INTRODUCTION	**Lectures Required:7** Synchronous and asynchronous paradigms of parallel computing.
II	HARDWARE TAXONOMY	**Lectures Required:7** Flynn's classification, Handler's classification, Software taxonomy, Kung's taxonomy, SPMD.
III	ABSTRACT PARALLEL COMPUTATIONAL MODELS	**Lectures Required:7** Combinational circuits, Sorting networks, PRAM models, interconnection RAMs.
IV	PARALLEL PROGRAMMING LANGUAGES	**Lectures Required:7** Performances Matrices - Laws governing performance measurements, metrics-speed up, efficiency utilization, communication, overheads, single/multiple programme performances, benchmarks.
V	PROCESSOR ARRAYS	**Lectures Required:7** Basic Algorithms - Fast Fourier Transform, Linear System Solution, Sorting etc.

EC 606.3 OPTIMIZATION TECHNIQUES

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T- **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INTRODUCTION	**Lectures Required:7** Historical development, Engineering application of optimization, Formulation of design problems as a mathematical programming problems, Classification of optimization problems.
II	LINEAR PROGRAMMING	**Lectures Required:7** Simplex methods, Revised simplex method, Duality in linear programming, post optimality analysis.
III		**Lectures Required:7** Applications of Linear programming, Transportation and assignment problems.
IV	NON-LINEAR PROGRAMMING	**Lectures Required:7** Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and Indirect methods.
V	DYNAMIC PROGRAMMING	**Lectures Required:7** Introduction, multi-decision processes, computational procedure

EC607 DIGITAL COMMUNICATION LAB

Teaching Hrs. **Exam. Hrs. – Practical**
P - 3 **Marks Practical Exam - 40 Sessional – 60 Total 100**

LIST OF EXPERIMENT

1. (a) To observe sampling of analog signal. Identify & solve the aliasing problem.
   (b) To observe the Transmission of two signals over a single channel using sampling methods.
2. TDM-PAM: Modulation & demodulation.
3. Operation of a PCM encoder & decoder.
4. TDM-PCM: Modulation & demodulation.
5. Observe the performance of a Delta modulation system & to derive from it a delta sigma modulation system.
6. To generate and study the various data formatting schemes (Unipolar,Bi-polar, Manchester,AMI etc.).
7. Generate ASK signals, with and without carrier suppression. Demodulation of these two types of modulated signal.
8. Generate the FSK wave forms & demodulate the FSK signals based on the properties of
   (a) Tuned circuits (b) PLL
9. Generate the PSK signals and demodulate it.

Simulation using Software:

10. To carry out convolution in both continuous *time* and discrete time systems.
11. Companding and multiplexing of PCM signals.
12. Perform various keying Techniques: PSK, ASK, FSK & MSK.

EC 608 ADVANCED MICROPROCESOR LAB

Teaching Hrs. **Exam. Hrs. – Practical**
P - 3 **Marks Practical Exam - 40 Sessional – 60 Total 100**

LIST OF EXPERIMENT

1. Write a Program for addition of 8 bit data 56 H & 55 H.
2. Write a Program for addition of 16 bit data 2525 H 1526 H.
3. Write a Program for multiplication.
4. Write a Program for dawdling
5. Write a Program for block move of byte.
6. Write a Program for add multi bytes.
7. Write a Program for find out largest from array.
8. Write a Program for fine out smallest form array.
9. Write a Program for find no. of byes in a string of bytes.
10. Write a Program for arrange gain data array in

(a) acceding order.
(b) Discarding order.

EC 609 HUMANITIES

Teaching Hrs. **Exam. Hrs. – Practical**
P - 3 **Marks Practical Exam - 40 Sessional – 60 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INDIA	**Lectures Required:** Brief History of Indian Constitution- framing, features, fundamental rights, duties, directive principles of state. History of Indian national movement, Socio economic growth after independence.
II	SOCIETY	**Lectures Required:** Social Groups- Concepts and types, socialization- concept and theory, social control; concept, social problem in contemporary India, status and role.
III	THE FUNDAMENTALS OF ECONOMICS	**Lectures Required:** Meaning, definition and importance of economics, Logic of choice, Central Economic Problems, Positive and Normative approaches, economic systems socialism and capatalism.
IV	MICROECONOMICS	**Lectures Required:** Law of demand and supply, Utility approach, Indifference curves, Elasticity of demand & supply and applications, Consumer surplus, Law of returns to factors and returns to scale.
V	MACRO ECONOMICS	**Lectures Required:** Concept relating to national product-National income and its measurement, Simple Keynesian theory, Simple multiplier, Money and banking,- Meaning, Concept of international trade, Determination of exchange rate, Balance of payments. Characteristics of Indian Economy.

EC 610 INDUSTRIAL ELECTRONICS LAB

Teaching Hrs. **Exam. Hrs. – Practical**
P - 2 **Marks Practical Exam - 40 Sectional – 60 Total 100**

LIST OF EXPERIMENT

1. Study the characteristics of SCR.
1.1 Observe the terminal configuration.
1.2 Measure the breakdown voltage.
1.3 Measure latching and holding current.
1.4 V-I characteristics.
2 Perform experiment on triggering circuits for SCR.
2.1 R-triggering circuit. 2.2 R-C triggering circuit.
2.3 UJT triggering circuit. 3 Study and obtain the characteristics of Diac.
4 Study and obtain the waveforms for single-phase half-wave controlled converter.
5 Study and obtain the waveforms for single-phase half controlled symmetrical and asymmetrical bridge converters.
6 Study and obtain the waveforms for single-phase fully controlled bridge converter.
7 Study and obtain the waveforms for voltage-commutated chopper.
8 Study and obtain the waveforms for current-commutated chopper.
9 Perform experiment on single phase PWM inverter.
10 Perform experiment on buck, boost and buck-boost regulators.
11 Perform experiment on Motor control – open loop & closed loop.

EC 701- ANTENNA & WAVE PROPAGATION

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	ANTENNA FUNDAMENTALS	**Lectures Required:7** Antenna parameters, Radiation from a current element in free space. Quarter & half wave antenna. Reciprocity theorem. Resonant and non-resonant antenna. Effective length and aperature, gain, beamwidth, directivity, radiation resistance, efficiency, polarization, impedance and directional characteristics of antenna, antenna temperature.
II	ANTENNAS	**Lectures Required:7** V and Rhombic antennas, Folded dipole, Yagi-Uda antenna, Frequency independent antennas, Log-periodic antennas,UHF and Microwave antennas- Antenna with parabolic reflectors, Horn and Lens antennas, Helical antennas, Square and Circular loop antennas,
III	ANTENNA ARRAYS	**Lectures Required:7** Two element array, N-element linear arrays, Broadside, End fire, collinear and combination arrays, Multiplication of patterns, Binomial arrays. Effect of ground on antennas, Antenna loading **Antenna Measurements -** Antenna impedance, radiation pattern, gain, directivity, polarization and phase measurements
IV	RADIO WAVE PROPAGATION-I	**Lectures Required:7** Mechanism of radio wave propagation, Reflection, Refraction interference and diffraction of radio waves. Theory of ground wave, space wave and sky wave propagation. Plane earth reflection, Reflection factors for horizontal and vertical polarizations. Duct propagation and tropospheric scattering.
V	RADIO WAVE PROPAGATION-II	**Lectures Required:7** Various Ionospheric layers. Characteristics of ionosphere and its effects on wave propagation. Critical frequency, Virtual height, skipzone & maximum usable frequency. Multiple hop transmission. Oblique & vertical incidence transmission. Effect of earth's magnetic field, solar activity and meteorological conditions on wave propagation.

EC 702 DIGITAL SIGNAL PROCESSING

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	SAMPLING	**Lectures Required:7** Discrete time processing of Continuous-time signals, continuous-time processing of discrete-time signals, changing the sampling rate using discrete-time processing.
II	TRANSFORM ANALYSIS OF LTI SYSTEMS	**Lectures Required:7** Introduction, The frequency response of LTI systems, System functions for systems characterized by LCCD (Linear Constant Coefficient Difference) equations, All-pass system, Minimum-Phase systems, Linear systems with linear phase.
III	STRUCTURES FOR DISCRETE-TIME SYSTEMS	**Lectures Required:7** Block diagram and signal flow graph representation of LCCD (LCCD – Linear Constant Coefficient Difference) equations, Basic structures for IIR and FIR systems, Transposed forms.
IV	FILTER DESIGN TECHNIQUES	**Lectures Required:7** Introduction, Analog filter Design: Butterworth & Chebyshev. IR filter design by impulse invariance & Bilinear transformation. Design of FIR filters by Windowing: Rectangular, Hanning, Hamming & Kaiser.
V	DISCRETE FOURIER TRANSFORM	**Lectures Required:7** The Discrete Fourier transform (DFT), Properties of the DFT, Linear Convolution using DFT. Efficient computation of the DFT: Decimation–in-Time and Decimation-in frequency FFT Algorithms. Processing of speech signals: Vocoders, linear predictive coders.

EC 703- WIRELESS COMMUNICATION

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**PROPAGATION PHENOMENA**	**Lectures Required:7** Fundamentals of fading, Multipath channels, Spread Spectrum signals: Direct-sequence spread spectrum signals, p-n sequences, Frequency-hopped spread spectrum signals, Code-division multiplexing.
II	**LINE OF SIGHT MICOWAVE COMMUNICATION**	**Lectures Required:7** Link Engineering, Frequency planning, Free space loss, Fresnel zone clearance bending of radio beam, Effective earth radius, Building blocks of Transmitter & Receiver.
III	**MULTIPLE ACCESS TECHNIQUES**	**Lectures Required:6** FDMA, TDMA and CDMA with reference to mobile radio and satellite systems. TDMA based networks. CDMA based networks,
IV	**CELLULAR WIRELESS NETWORKS**	**Lectures Required:7** GSM: Introduction, overview of the GSM systems, GSM codec, channel coding and interleaving, radio like control. Cordless systems and WLL, Mobile IP, Wireless access protocol. Wireless LAN's: Technology, IEEE 802.11 standards and Blue tooth. Broadband Wireless 802.16
V	**SATELLITE COMMUNICATION**	**Lectures Required:8** Elements of satellite communication: Frequency bands, Transmission and multiplexing. Modulation, Multiple access. Satellite orbit and description- orbital period and velocity, effects of orbital inclination, Azimuth and elevation, Coverage angle and slant range, Geostationary orbit, Satellite description. Earth Station antenna, high-power amplifier, low-noise amplifier, up converter, down converter, monitoring and control, reliability. Satellite Link: basic link analysis,

1. G. Stuber *Principles of Mobile Communication Systems*, Kluwer Academic Publishers, 1996.
2. K. Pahlavan and A. Levesque, *Wireless Information Networks*, John Wiley & Sons, Inc, 1995.
3. Principles & applications of GSM – Vijay K. Garg, and J.E. Wilkes 1999 – Prentice hall PTR.
4. Principal of Mobile Communications by Rappapart

EC 704-I C TECHNOLOGY

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**INTRODUCTION TO TECHNOLOGIES**	**Lectures Required:7** Semiconductor Substrate-Crystal defects, Electronic Grade Silicon, Czochralski Growth, Float Zone Growth, Characterization & evaluation of Crystals; Wafer Preparation- Silicon Shaping, Etching and Polishing, Chemical cleaning.
II	**DIFFUSION & ION IMPLANTATION**	**Lectures Required:7** Ficks diffusion Equation in One Dimension, Atomic model, Analytic Solution of Ficks Law, correction to simple theory , Diffusion in SiO2. Ion Implantation and Ion Implantation Systems Oxidation. Growth mechanism and Deal-Grove Model of oxidation, Linear and Parabolic Rate co-efficient, Structure of SiO2, Oxidation techniques and system, Oxide properties.
III	**CHEMICAL VAPOUR DEPOSITION AND LAYER GROWTH**	**Lectures Required:7** CVD for deposition of dielectric and polysilicon – a simple CVD system, Chemical equilibrium and the law of mass action, Introduction to atmospheric CVD of dielectric, low pressure CVD of dielectric and semiconductor. Epitaxy-Vapour Phase Expitaxy, Defects in Epitaxial growth, Metal Organic Chemical Vapor Deposition, Molecular beam epitaxy.
IV	**PATTERN TRANSFER-**	**Lectures Required:7** Introduction to photo/optical lithography, Contact/ proximity printers, Projection printers, Mask generation, photoresists. Wet etching, Plasma etching, Reaction ion etching.
V	**VLSI PROCESS INTEGRATION**	**Lectures Required:7** Junction and Oxide Isolation, LOCOS methods, Trench Isolation, SOI; Metallization, Planarization. Fundamental consideration for IC Processing, NMOS IC Technology, CMOS IC Technology, Bipolar IC Technology.

EC705- VLSI DESIGN

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**INTRODUCTION TO MOS TECHNOLOGY**	**Lectures Required:7** Basic MOS transistors, Enhancement Mode transistor action, Depletion Mode transistor action, NMOS and CMOS fabrication.
II	**BASIC ELECTRICAL PROPERTIES AND CIRCUIT CONCEPTS**	**Lectures Required:7** Ids versus Vds relationship, aspects of threshold voltage, transistor trans conductance gm, the NMOS inverter, pull up to pull-down ratio for a NMOS inverter and COMS inverter (Bn/Bp), MOS transistor circuit model, noise margin.
III	**COMS LOGIC CIRCUITS:**	**Lectures Required:7** The inverter, combinational logic nand gate, NOR gate, compound gate 2 input CMOS multiplexers, memory latches & registers, transmission gate, gate-delay, CMOS-gate transistor sizing, power dissipation.
IV	**BASIC PHYSICAL DESIGN:**	**Lectures Required:7** Physical design rules, physical design of simple gates & layout issues. Layout issues for inverter, layout for NAND & NOR gate complex logic gates layout, layout optimization for performance
V	**INTRODUCTION TO VHDL:**	**Lectures Required:7** Prolog & other design tools. VHDL Code for simple Logic gates, flip-flops, shift registers.

Books: Text Books

1. S.M. Kang & Y. Leblibici: 'CMOS Digital Integrated Circuits Analysis & Desgin' TMH
2. B.G. Streetman & S. Banerjee: 'Solid State Electronic Design" PHI.
3. K.Eshraghian & Pucknell: 'Introduction to VLSI' PHI.
4. VHDL Primer by J. Bhaskar Addison Wesley Longman Pub.
5. VHDL: Analysis & modeling of Digital systems by Z Noyabi Mc-Graw Hill Pub.

EC 706.1 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**INTRODUCTION TO AI KNOWLEDGE**	**Lectures Required:** Importance of AI, Knowledge Base System Knowledge organization & manipulation, Conceptual Introduction to LISP and other AI programming Languages.
II	**KNOWLEDGE REPRESENTATION**	**Lectures Required:** Syntax Semantics, Inference Rules, Non-deductive Inference methods, and representations using rules, forward chaining and backward chaining. Fuzzy Logic & Natural languages computations. Probabilistic Reasoning. Object Oriented Representations.
III	**KNOWLEDGE ORGANIZATION & MANIPULATION-**	**Lectures Required:** Search & control strategies, matching techniques, knowledge organization & management, Genetic Algorithms based search techniques.
IV	**KNOWLEDGE SYSTEMS ARCHITECTURE**	**Lectures Required:** Rule based, non-production, uncertainty knowledge system building tools.
V	**KNOWLEDGE ACQUISITION**	**Lectures Required:** General concepts, learning by induction.

EC 706.2- MULTIMEDIA SYSTEMS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INTRODUCTION TO MULTIMEDIA	**Lectures Required:8 Pds.** Introduction to Multimedia, multimedia information, multimedia objects, multimedia in business and work convergence of computer, communication and entertainment products and stages of multimedia projects, multimedia hardware, memory & storage devices, communication devices, multimedia software's presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.
II	MULTIMEDIA BUILDING BLOCKS	**Lectures Required: 8 Pds.** Multimedia building blocks text, sound MIDL . digital Audio, audio file formats. MIDI under windows environment audio & video capture.
III	DATA COMPRESSION	**Lectures Required: 8 Pds.** Data compression Huffman coding, Shannon fano algorithm, Huffman algorithms, adaptive coding, arithmetic coding higher order modeling, finite context modeling dictionary based compression, sliding window compression, EZ77, EZW compression, compression. Compression ratio loss less & lossy compression.
IV	SPEECH COMPRESSION	**Lectures Required: 8 Pds.** Speech compression & synthesis digital audio concepts. Sampling variables, loss less compression of sound, loss compression & silence compression.
V	IMAGES	**Lectures Required: 8 Pds.** Multiple monitors, bitmaps, vector drawing, lossy graphic compression, image file formatic animations images standards, JPEG compression, zig zag coding. Multimedia database. Content based retrieval for text and images, video: Video representation, colors, video compression, MPEG standards, MHEG standard video streaming on net, video conferencing, recent development in multimedia.

EC 706.3 IMAGE PROCESSING AND PATTERN RECOGNITION

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	INTRODUCTION	**Lectures Required:** Imaging in ultraviolet and visible band. Fundamental steps in image processing. Components in image processing. Image perception in eye, light and electromagnetic spectrum, Image sensing and acquisition using sensor array.
II	DIGITAL IMAGE FUNDAMENTALS	**Lectures Required:** Image sampling and quantization, Representing digital images, Spatial and gray-level resolution, Aliasing and Moiré patterns, Zooming and Shrinking digital images.
III	IMAGE RESTORATION	**Lectures Required:** Image restoration model, Noise Models, Spatial and frequency properties of noise, noise probability density functions, Noise - only spatial filter, Mean filter Statistic filter and adaptive filter, Frequency domain filters - Band reject filter, Band pass filter and Notch filter.
IV	IMAGE COMPRESSION	**Lectures Required:** Compression Fundamentals - Coding Redundancy, Interpixel redundancy, Psycho visual redundancy and Fidelity criteria. Image Compression models, Source encoder and decoder, Channel encoder and decoder, Lossy compression and compression standards. color space formats, scaling methodologies (like horizontal, vertical up/down scaling). Display format (VGA, NTSC, PAL).
V	EXPERT SYSTEM AND PATTERN RECOGNITION	**Lectures Required:** Use of computers in problem solving, information representation, searching, theorem proving, and pattern matching with substitution. Methods for knowledge representation, searching, spatial, temporal and common sense reasoning, and logic and probabilistic inferencing. Applications in expert systems and robotics.

1. Digital Image Processing : Gonzalez & Wood, Addison-Wisley Publisher Comp. 1993.
2. Digital Image Processing : A.K Jain, PHI, Edition 1995.

EC 707 DIGITAL SIGNAL PROCESSING LAB

Teaching Hours **Exam. Hrs. – Practicle**
P - 2 **Marks Practicle Exam - 30 Sessional – 45 Total 75**

LIST OF EXPERIMENTS

Modeling and simulation using MAT LAB

1. Realising a given block diagram having multiplier, adder/subtractor and system (Discrete/Continuous) with given Impulse response. Calculating output for given input.
2. To simulate the transmitter and receiver for BPSK
3. To design and simulate FIR digital filter (LP/HP).
4. To design and simulate IIR digital filter (LP/HP).

DSP Lab using TMS320C6XXX DSP Kits

5. To study the architecture of TMS320C6XXX DSP kits using Bloom with DSP.
6. To generate wave form (SINE, COSINE, SQUARE & TRIANGULAR).
7. Verification of Sampling Theorem.
8. Verification of linear/circular convolution.
9. To design FIR and FIR digital filter (LP/HP).

EC 708 WIRELESS COMMUNICATION LAB

Teaching Hours **Exam. Hrs. – Practicle**
P - 2 **Marks Practicle Exam - 60 Sessional – 40 Total 100**

LIST OF EXPERIMENTS

1. Measurement of antenna characteristics : Radiation Pattern on polar plots, Beam width and Gain of main lobe for the following types of antennas.

(a) Half wave and quarter wave dipole
(b) Folded dipole
(c) Yagi UDA multiple element folded dipole
(d) Hertz Antenna
(e) End fire array and broad side array
(f) Helix antenna
(g) Paraboloid reflector antenna
(h) Loop antenna
(i) Ground plane antenna
(j) Log periodic antenna
(k) Rhombus antenna
(l) Slot antenna

2. Demonstration of modeling of wire antenna using appropriate design software.
3. Simulation of antenna arrays using appropriate software.
4. Design and testing of microstrip rectangular patch antenna using appropriate software.
5. Investigate the transmission characteristics of the link and measure the gain of the microstrip patch antennas. Draw the antenna radiation diagram.
6. Radar Trainer: Working of Doppler radar, velocity of moving object, time and frequency measurement and other applications.
7. To perform Modulation, Demodulation and BER measurement using CDMA – DSSS Trainer.
8. To establish analog/digital communication link and transmit & receive three signals (audio, video, tone) simultaneously using Satellite Communication Trainer.
9. To study GPS Receiver, establishing link between GPS satellite & GPS trainer and measure of latitude & longitude

EC 801 COMPUTER NETWORKS-I

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	QUEUING THEORY	**Lectures Required:7** Pure birth, Pure death & Birth-death processes, Mathematical models for M/M/1, M/M/□, M/M/m, M/M/1/K and M/M/m/m queues. Little's formula. M/G/1 Queuing model basics.
II	DATA LINK LAYER	**Lectures Required:7** Packet & Circuit switching, OSI & TCP/IP Reference Models, Framing, Simplex protocol, Simplex stop & wait protocol, Sliding window protocol, Go back N protocol, selective repeat, HDLC, Data link layer in internet.
III	MEDIUM LAYER	**Lectures Required:7** Static & dynamic channel allocation, Multiple Access Protocols: ALOHA, slotted ALOHA, CSMA, Token Bus, Token Ring, FDDI, IEEE standards 802.2, 802.3 Hubs, Bridges, Routers & Gateways.
IV	NETWORK LAYER	**Lectures Required:7** Network layer Design issues. Adaptive & Non-adaptive routing algorithms, Congestion control algorithms for TCP/IP networks, Internetworking, Network layer in the Internet: IPv4 & IPv6 Protocols, OSPF and BGP. TCP Protocol architecture.
V	ATM NETWORKS	**Lectures Required:7** Connection Oriented Networks: X.25, Frame Relay & ATM. ISDN system architecture. Broadband ISDN. ATM Protocol architecture, Recognition Algorithm in ATM Networks, Congestion control Algorithms.

Recommended Books:

1. Tanenbaum. Computer Networks, Pearson Education of Asia.
2. Gallager -Data Networks, Prentice Hall of India.
3. Stallings -Data & computer Communication, Pearson Education Asia.
4. Trivedi -Probability and Statistics with reliability, Queuing and Computer Science
5. Forouzan -Data Communication and Networking, Tata Mc-Graw Hill.

EC 802- RADAR & TV ENGINEERING

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	RADAR	**Lectures Required: 8 Pds.** Radar Block diagram, frequencies and applications. Radar range equation. Continuous wave (CW) & FM radar; Moving target indicator (MTI) : Delay line cancellers, blind velocity Pulse Doppler Radar. Tracking radar sequential lobbing, Conical scan and monopulse radar, Types of display, Radar receivers, Noise figure.
II	NAVIGATIONAL AIDS	**Lectures Required: 8 Pds.** Principle of operation of Radar direction finder & range system. LORAN system, DME, TACAN, Aircraft landing systems..
III	TV ENGINEERING-I	**Lectures Required: 6 Pds.** Theory of scanning standards, Principles of Monochrome and colour T.V. system (PAL, SECAM, NTSC). Composite video signal analysis. T.V Cameras : Image orthicon, plumbicon, vidicon. CCD camera tubes. Types of Monochrome and colour picture tubes, set-up adjustments. LCD and Plasma displays
IV	TV ENGINEERING-II	**Lectures Required: 6 Pds.** Picture, colour and sound carriers. Vestigial side band transmission. Encoding picture information. Chrominance modulation. Compatibility of colour and monochrome T.V. systems. Block diagram of T.V. transmitters. TV transmission & reception antennas.
V	TV RECEIVER	**Lectures Required: 8 Pds.** Functional block diagram of T.V. receiver, R.F. Tuner, I.F. amplifier, Video detector, video amplifier, AGC, Synch. Separation, Sync. Processing and AFC. Deflection oscillators, vertical & horizontal deflection and sound system circuits. EHT generation. Common faults and their diagnosis. Basic idea of HDTV, DBS-TV and 3D-TV.

EC 803-OPTICAL COMMUNICATION

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**OPTICAL FIBERS**	**Lectures Required:8** Basic optical laws and definitions, Principles of light propagation in fibers, Ray theory, Optical fiber modes and configurations, Step index and graded index fibers, Monomode and multimode fibers, Fiber materials, fiber fabrication, Fiber optic cables. Attenuation, signal distortion in optical fibers, Dispersion-intra modal & inter modal, Dispersion shifted and flattened fiber
II	**OPTICAL SOURCES**	**Lectures Required:7** LED's- Structure, Materials, Characteristics, Modulation, Power & efficiency, Laser Diodes - Basic concept, Hetro Structure, properties and modulation
III	**OPTICAL DETECTORS**	**Lectures Required:7** - PIN and Avalanche photo diodes, photo detector noise, detector response time, Avalanche multiplication noise. Photo diode materials. Fundamental of Optical Receiver Operation.
IV	**OPTICAL FIBER COMMUNICATION SYSTEMS**	**Lectures Required:7** Source to fiber coupling, fiber to fiber joints, fiber splicing, fiber connectors. Principal components. Link design calculation, Applications, Wavelength division multiplexing
V	**OPTICAL FIBER MEASUREMENTS**	**Lectures Required:6** Measurements of Fiber attenuation, Dispersion, refractive index profile, Numerical aperture & diameter.

1. Optical Fiber communication by Senior JM
2. Optical Fiber communication by Gerd Keiser
3. Introduction to Optical Fiber by Allien H. Chairin
4. Optical communication by RM Gagliardi & S. Karp

EC 804.1 VHDL Design

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**INTRODUCTION**	**Lectures Required:7** Fundamental & history of various hardware description language, Design flow of ASICs and and standard logic circuits using software.
II	**COMBINATIONAL CIRCUIT BUILDING BLOCKS**	**Lectures Required:7** Multiplexer, Decoders, encoders, Code Converters, VHDL Code for Combinational Circuits.
III	**SEQUENCIAL CIRCUITS**	**Lectures Required:7** VHDL code for Flip-Flops, shift registers, Counters.
IV	**SYNCHRONOUS/ ASYNCHRONOUS SEQUENCIAL CIRCUITS**	**Lectures Required:7** Mealy & Moore type FSMs, VHDL Code for Mealy & Moore Machines, VHDL Codes for Serial Adder, Vending Machine.
V	**DIGITAL SYSTEM DESIGN**	**Lectures Required:7** Building Block circuits, Memory organization, SRAM, Design examples of divider, Multiplier, Shifting & Sorting Operations, Clock Synchronization, CPU organization and design concepts.

EC 804.2- MICROCONTROLLER AND EMBEDDED SYSTEMS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**THE 8051 MICROCONTROLLER**	**Lectures Required: 8 Pds.** Introduction, The 8051 microcontroller hardware, I/O pins, port, external memory, counters and timers, serial data interrupts.
II	**8051 ASSEMBLY LANGUAGE PROGRAMMING**	**Lectures Required: 8 Pds.** Addressing modes, external data moves push and pop opcodes, logical operations. Byte level and bit level logical operations. Arithmetic operation, jump and call instructions, interrupts & returns.
III	**REAL TIME CONTROL**	**Lectures Required: 6 Pds.** Interrupts, multiple sources of interrupts. Non maskable sources interrupts. Interrupt structure in 8051, timers, free running counter & real time control.
IV	**SYSTEM DESIGN INTRODUCTION TO EMBEDDED SYSTME**	**Lectures Required: 6 Pds.** Overview of embedded system: Embedded system, categories and requirements of Embedded system., challenges and issues in Embedded software development, applications of Embedded system in consumer electronics, control system, biomedical systems, handheld computers, communication, Embedded system development process, embedded operating systems, types of Embedded operating systems devices serial I/O interface. Parallel I/O ports interface, digital and analog interfacing methods, LED array, keyboard, printer, flash memory interfacing.
V	**APPLICATION OF MICROCONTROLLERS**	**Lectures Required: 8 Pds.** Application of microcontrollers in interfacing, robotics, MCU based measuring instruments, real time operating system for system design, multitasking system, tasks definition in a multitasking system, round robin scheduling. Full pre-emptive scheduling basic study and features of commercial RTORS: wince AND Embedded Linux.

EC 804.3 SATELLITE COMMUNICATIONS

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T-1 **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I	**SATELLITE SYSTEMS, ORBITS AND LAUNCHING METHODS**	**Lectures Required:** Introduction – Frequency Allocations for Satellite Services –Polar Orbiting Satellites –Kepler's First Law – Kepler's Second Law – Kepler's Third Law – Definitions of Terms for Earth-orbiting Satellites – Orbital Elements – Apogee and Perigee Heights – Orbital Perturbations
II	**GEOSTATIONARY ORBIT & SPACE SEGMENT**	**Lectures Required:** Introduction – Antenna Look Angels – The Polar Mount Antenna – Limits of Visibility – Near Geostationary Orbits – Earth Eclipse of Satellite – Sun Transit Outage – Launching Orbits – Power Supply – Attitude Control – Spinning Satellite Stabilization – Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders – Wideband Receiver – Input Demultiplexer – Power Amplifier – Antenna Subsystem
III	**EARTH SEGMENT & SPACE LINK**	**Lectures Required:** Transmit-Receive Earth Stations– Equivalent Isotropic Radiated Power – Transmission Losses – Free-Space Transmission – Feeder Losses – Antenna Misalignment Losses – Fixed Atmospheric and Ionospheric Losses – Link Power Budget Equation – System Noise – Antenna Noise – Amplifier Noise Temperature – Amplifiers in Cascade – Noise Factor – Noise Temperature of Absorptive Networks – Overall System Noise Temperature – Carrier-to-Noise Ratio – Uplink – Saturation Flux Density – Input Back Off – The Earth Station HPA – Downlink – Output Back off – Satellite TWTA Output– Combined Uplink and Downlink C/N Ratio – Intermodulation Noise.
IV	**SATELLITE ACCESS**	**Lectures Required:** Single Access – Preassigned FDMA, Demand-Assigned FDMA, SPADE System. Bandwidth-limited a Power-limited TWT amplifier operation, FDMA downlink analysis. TDMA : Reference Burst; Preamble and Postamble, Carrier recovery, Network synchronization, unique word detection, Traffic Date, Frame Efficiency and Channel capacity, preassigned TDMA, Demand assigned TDMA, Speech Interpolation and Prediction, Downlink analysis for Digital transmission. Code-Division Multiple Access – Direct-Sequence spread spectrum – code signal c(t) – autocorrelation function for c(t) – Acquisition and tracking – Spectrum spreading and dispreading
V	**DIRECT BROADCAST SATELLITE SERVICES**	**Lectures Required:** Introduction – Orbital Spacings – Power Rating and Number of Transponders – Frequencies and Polarization – Transponder Capacity – Bit Rates for Digital Television – Home Receiver Indoor Unit (IDU) – Downlink Analysis – Uplink -Problems - Satellite Mobile Services – VSATs.

TEXT BOOK

1. Dennis Roddy, Satellite Communications, McGraw-Hill Publication Third edition 2001
2. Timothy Pratt – Charles Bostian & Jeremy Allmuti, Satellite Communications, John Willy & Sons (Asia) Pvt. Ltd. 2004
3. Wilbur L. Pritchars Henri G.Suyder Hond Robert A.Nelson, Satellite Communication Systems Engineering, Pearson Education Ltd., Second edition 2003.
4. M.Richharia : Satellite Communication Systems (Design Principles Macmillan Press Ltd. Second Edition 2003.
5. D C Agarwal: Modern Satellite Communications.

EC 805- COMPUTER NETWORK PROGRAMMING LAB

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T **Marks Theory Exam -60 Term Test – 40 Total 100**

1. **PRELIMINARIES:** Study and use of common TCP/IP protocols and term viz. telnet rlogin ftp, ping, finger, Socket, Port etc.
2. **DATA STRUCTURES USED IN NETWORK PROGRAMMING:** Representation of unidirectional, , Directional weighted and unweighted graphs.
3. **ALGORITHMS IN NETWORKS:** computation of shortest path for one source-one destination and one source –all destination.
4. **SIMULATION OF NETWORK PROTOCOLS:**

(i) Simulation of M/M/1 and M/M/1/N queues.
(ii) Simulation of pure and slotted ALOHA.
(iii) Simulation of link state routing algorithm.

5. **Case study : on LAN Training kit**

(i) Observe the behavior & measure the throughput of reliable data transfer protocols under various Bit error rates for following DLL layer protocols-

a. Stop & Wait
b. Sliding Window : Go-Back-N and Selective Repeat

(ii) Observe the behavior & measure the throughput under various network load conditions for following MAC layer Protocols

a. Aloha
b. CSMA, CSMA/CD & CSMA/CA
c. Token Bus & Token Ring

6. **DEVELOPMENT OF CLIENT SERVER APPLICATION:**

i) Develop 'telnet' client and server which uses port other than 23.
(ii) Write a finger application which prints all available information for five users currently logged on and are using the network for longest duration. Print the information in ascending order of time.

EC 806- INDUSTRIAL ECONOMICS AND MANAGEMENT LAB

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-3 T **Marks Theory Exam -80 Term Test – 20 Total 100**

CONTENTS OF SYLLABUS

Unit	Topics	Details of Coverage
I		Organizational forms, Profit maximization and other objectives of industrial firms, Theory of profitability, Economies of scale. Financing of Industries- Need and sources of finance, Role of special financial institutions, Investment criteria-NPV, IRR.
II		Approaches to industrial location analysis, Productivity analysis, Input-Output analysis, Concentration of economic power. New Industrial Policy – Critical analysis, Role of technology and entrepreneurship in industrial development.
III		Management – Principles of management, functions-planning, Organization staffing, Directing, Controlling, Coordination, Decision making.
IV		Production Management – Total quality management, JIT, Quality circle, Quality-ISO9000, ISO14000, KANBAN, Bench marking, Effective communication.
V		Labour Legislations.

EC 807- VLSI & Optical fiber LAB

Teaching Hrs. **Exam. Hrs. – 3 Hrs.**
L-2 T **Marks Theory Exam -80 Term Test – 20 Total 100**

LIST OF EXPERIMENTS

PART-I

Schematic design and make Device Level Layout of following circuits.

1. BJT/FET Amplifier in various configuration..
2. Counters, Shift Registers & Sequence Decoders.
3. Various circuits with Op-Amp.

PART-II

Design of following ckt using appropriate software like VHDL/ FPGA.

4. 3-input NAND gate.
5. Half adder.
6. D-Latch.
7. Serial in-serial out shift register.

PART-III

To perform following experiments based on Fiber Optic Trainer.

8. To set up Fiber Optic Analog link.
9. To set up fiber Optic Digital link.
10. Measurement of Propagation loss and numerical aperture.
11. Characterization of laser diode and light emitting diode.