Course Structure & Curriculum
For
B. Tech. Programme

In
ELECTRONICS & COMMUNICATION ENGINEERING

Department of Electronics & Communication Engineering
Motilal Nehru National Institute of Technology Allahabad

Curriculum for
Bachelor of Technology in
(Electronics and Communication Engineering)

3rd Semester (Electronics and Communication Engineering)

Course Code	Course name	L	T	P	Credit
EC-1301	Principles of Electronics Engineering	3	1	0	4
MA-1302	Mathematics-III	3	1	0	4
CS-1302	Data Structures and Operating Systems	3	0	0	3
MA-1303	Numerical Methods and Statistical Techniques	3	0	0	3
EE-1305	Principles of Electrical Engineering and Measurement	3	0	0	3
EC-1302	Signals and Systems	3	0	0	3
EC-1351	Electronics Engineering (Lab)	0	0	3	2
EE-1352	Electrical Engineering and Measurement (Lab)	0	0	3	2
CS-1353	Data Structure (Lab)	0	0	3	2
	Total	18	2	9	26

4th Semester (Electronics and Communication Engineering)

Course Code	Course name	L	T	P	Credit
EC-1401	Analog Communication	3	1	0	4
EC-1402	Digital Electronics	3	1	0	4
EE-1404	Networks & Systems	3	0	0	3
EC-1403	Electromagnetic Theory	3	1	0	4
EC-1404	Electronic Devices and Circuits	3	0	0	3
HS-1401	Principles of Management	3	0	0	3
EC-1451	Analog Communication (Lab)	0	0	3	2
EC-1452	Digital Electronics (Lab)	0	0	3	2
EC-1453	Electronic Devices and Circuits (Lab)	0	0	3	2
	Total	18	3	9	27

5th Semester (Electronics and Communication Engineering)

Course Code	Course name	L	T	P	Credit
EC-1501	VLSI Technology and Device Modeling	3	0	0	3
EC-1502	Microprocessors and Its Applications	3	0	0	3
EC-1503	Antenna and Wave Propagation	3	0	0	3
EC-1504	Electronic Circuit Design	3	1	0	4
EC-1505	Digital Communication	3	0	0	3
EE-1505	Automatic Control Systems	3	0	0	3
EC-1551	Microprocessors (Lab)	0	0	3	2
EC-1552	Electronic Circuit Design (Lab)	0	0	3	2
EC-1553	Digital Communication (Lab)	0	0	3	2
EE-1554	Automatic Control Systems (Lab)	0	0	3	2
	Total	18	1	12	27

6th Semester (Electronics and Communication Engineering)

Course Code	Course name	L	T	P	Credit
EC-1601	Digital Signal Processing	3	0	0	3
EC-1602	RF and Microwave Engineering	3	0	0	3
EC-1603	Data Communication and Networks	3	1	0	4
EC-1604	Optical Communication	3	0	0	3
EC-1605	Microelectronics and VLSI Design	3	0	0	3
EC-1 606	Computer Architecture	3	0	0	3
HS-1601	Communication Skill Workshop	0	0	2	0
EC-1651	Digital Signal Processing (Lab)	0	0	3	2
EC-1652	Microwave Engineering (Lab)	0	0	3	2
EC-1653	Microelectronics and VLSI Design (Lab)	0	0	3	2
	Total	18	1	11	25

7th Semester (Electronics and Communication Engineering)

Course Code	Course name	L	T	P	Credit
EC-1701	Mobile and Wireless Communication	3	0	0	3
OE-1781 to 1790	Open Elective – I	3	0	0	3
EC-1731 to 1740	Professional Elective – I	3	1	0	4
EC-1741 to 1750	Professional Elective – II	3	1	0	4
EC-1751	Lab Elective	0	0	3	2
EC-1791	Project	0	0	12	6
	Total	12	2	15	22

8th Semester (Electronics and Communication Engineering)

Course Code	Course name	L	T	P	Credit
OE-1881 to 1890	Open Elective – II	3	0	0	3
EC-1801	Advanced Digital Signal and Image Processing	3	1	0	4
EC-1831 to 1840	Professional Elective – III	3	1	0	4
EC-1841 to 1850	Professional Elective – IV	3	1	0	4
EC-1851	Advanced Digital Signal and Image Processing (Lab)	0	0	3	2
EC-1891	Project	0	0	12	6
	Total	12	3	15	23

1st digit; 1: UG, 2nd digit; 2, 3, etc.: Semester

Code	Description
01-30	Theory Courses
31-40	Professional Elective –I
41-50	Professional Elective –II
51-70	Practical Courses
81-90	Open Elective
91-99	Project

PRINCIPLES OF ELECTRONICS ENGINEERING (EC-1301)

UNIT 1: Diodes- Introduction to *pn* diode and its applications as rectifier, rectifier as DC Power Supply, Clamper, Clipper, Voltage multiplier etc., Zener diode and its applications as regulator, Tunnel diode and Varactor diode. 8(L)

UNTI 2: Transistors-Review of Transistor working, characteristics & its parameters, Transistor as an amplifier, Biasing of bipolar junction transistors, *h*-parameters & transistor equivalent circuits, small signal single-stage amplifier, frequency response, concept of feedback. 8(L)

JFET and MOSFET Basic construction, working, concept of pinch-off, characteristics of JFET, MOSFET (Enhancement and Depletion), FET as a voltage variable resistor. 6(L)

UNIT3: Operational amplifier-Ideal & non-ideal characteristics, concept of summing junction and virtual ground. Application of operational amplifier as: Adder, Subtractor, Differentiator, Integrator, Multiplier, Unity gain amplifier & Logarithmic amplifier. 6(L)

UNIT 4 Introduction to Digital Electronics: Review of number systems, complements, codes, Boolean algebra, Logic gates, Minterm and Maxterms, Canonical and Standard forms, Logic functions & Logic circuits. Minimization of Boolean functions using K-map. 6(L)

UNIT 5 Measuring Instruments: Working of Cathode Ray Oscilloscope, Power supply, Multimeter and Function generator 6(L)

Text/ Reference Books:

- Electronic devices and circuit theory by Robert Boylested and Louis Nashelsky
- Electronic principles by Albert Malvino
- Integrated Electronics by Jacob Millman, Chistos C. Halkias
- Digital design by Morris Mano
- Modern Digital Electronics by R. P. Jain
- Modern electronics Instrumentation and Measurement Techniques by A. D. Helfrick and W. D. Cooper

MATHEMATICS -III (MA-1302)

UNIT 1: Power Series Solution-Ordinary and Singular points, Regular Points, Irregular Points, Power Series Solution, Frobenius Method. 4(L)

UNIT 2: Legendre Polynomial, Bessel's Functions, Strum-Liouville Problem-Legendre Differential Equations and Legendre Polynomials, Rodrigue's Formula, Generating Functions, Recurrence Relation, Orthogonal Properties of Legendre Polynomials, Bessel's Differential Equations and Bessel's functions, Recurrence Relation, Orthogonal Properties of Bessel's Function. Sturm-Liouville problem, orthogonal polynomials and functions. 8(L)

UNIT 3: Function of Complex Variables-Function of a complex variable, Analyticity, Analytic function, Cauchy-Riemann Equation, Harmonic Function, Application of analytic function to flow problem, Construction of Analytic function, Conformal mapping and Bilinear Transformation 8(L)

UNIT 4: Contour Integration-Contour/Complex Integration, Cauchy's integral theorem and formula, Morera's Theorem, Zeros & Singularity, Calculus of Residue, Residue's Theorem,. 6(L)

UNIT 5: Probability Theory-Axiomatic definition of probability, Conditional probability and Baye's theorem, Random Variables, Discrete Random Variables, Continuous Random Variables, Probability function of Discrete Random Variables, Distribution function, Mean & Variance, Expectation and moments, Moment Generating functions. 6(L)

UNIT 6: Binomial, Poisson and Normal distributions-Binomial and Poisson Distributions, Normal Distribution, Mean &Variance, Moment Generation Function, Normal approximation to Binomial distribution, Mean, Variance, Median & Mode, Moment Generation Function, Mean Deviation from Mean. 6(L)

Text/ Reference Books:

- Legendre polynomials and factions by Refaat Elattar
- Complex Variables by Francis J. Flanigan
- Engineering Maths 4th Edtion by Anthony croft, Robert Darison, Martin Hargreaven, James Flint
- Advanced Engineering Mathematics by L.R. Mustole
- Random variables & stochastic process by Papoulis.

DATA STRUCTURES AND OPERATING SYSTEMS (CS-1302)

UNIT 1: Basic Computer Architecture, Function and structure of Hardware and Software Components, CPU, ALU, Memory, I/O devices, System Software, Application Software. 6(L)

UNIT 2: Introduction, Motivation, and Overview of an Operating System with an emphasis on its role as a Manager of Hardware Resources, History of Computer Hardware (including a review of H/W structures) and how Operating Systems Evolved in tandem with the Hardware. 7(L)

UNIT 3: Programming software (Writing software),Program and Process, Program specifications and design, Abstract data types, Basics of C, Time and space complexity of Programs. 5(L)

UNIT 4: Need of Data Structures, Linear and nonlinear Data structure, Stack, Queue, Tree, Graph, B-tree 5(L)

UNIT 5: Processor and Memory Management, Process Management, Concurrent Process, Semaphores, Fork and Join, CPU Scheduling including Preemptive, and Non-Preemptive, Application of Stack and Queue, Sequential and linked implementation, in designing program for CPU and Disk scheduling, Page Tables, Page Replacement Algorithms. 7(L)

Text/ Reference Books:

- Fundamentals of data structures by Horowitz and Sahni
- Data Structure Using C by Tanenbaum
- Operating System Concepts, Abraham Silberschatz and Peter Galvin

NUMERICAL METHODS AND STATISTICAL TECHNIQUES (MA-1303)

UNIT 1: Algebraic and Transcendental Equations-Errors in numerical computation and their analysis, Bisection method, Iteration method, Newton-Raphson Method, Method of False Position, rate of convergence, Method for complex root, Muller's Method, Quotient Difference method. 8(L)

UNIT 2: Interpolation-Introduction, Errors in Polynomial interpolation, Finite differences, Decision of errors, Newton's formula for interpolation, Gauss, Sterling, Bessel's, Everett's Formula, Interpolation by unevenly spaced points, Lagrange interpolation formula, Divided Difference, Newton's General interpolation Formula. 9(L)

UNIT 3: Curve Fitting, Cubic Spline & Approximation-Introduction, Method of Least Square curve fitting procedures, Fitting a straight line, Curve fitting by sum of exponential, Data fitting with cubic splines, Approximation of functions. 7(L)

UNIT 4: Numerical Integration and Differentiation-Introduction, Numerical differentiation, Picard Iteration Method of Solution, Numerical integration, Trapezoidal rule, Simpson 1/3 rule, Simpson 3/8 rule, Booles & Weddles rule, Euler- Maclaurin's formula, Gaussian Formula, Numerical evaluation of singular integrals. 5(L)

UNIT 5: Numerical Linear Algebra-Numerical techniques for finding solution of system of linear equations and eigen values: Gauss Jordan, Gauss Seidel methods, Power method for estimating eigen values: LU and LL* factorization of matrices. 6(L)

UNIT 6: Statistical Computations-Frequency Chart, Regression Analysis, Least Square fit, Polynomial fit, Linear and Nonlinear Regression, Multiple Regression, Statistical Quality Control Methods. 7(L)

Text/ Reference Books:

- C. F. Gerald and P.O.Wheatley, Applied Numerical Analysis, Pearson Education
- M.K.Jain, S.R.K.Iyenger and R.K.Jain, Numerical Methods for Scientific and Engineering
- Computation, Wiley Eastern Ltd.
- S.S Sastry, Introductory Methods of Numerical Analysis, Prentice Hall
- S. Rajasekharan, Numerical Methods for Science and Engineering, S.Chand.
- James I. Buchman and Peter R.Turner, Numerical Methods and Analysis, McGraw-Hills Inc.

PRINCIPLES OF ELECTRICAL ENGINEERING AND MEASUREMENT (EE-1305)

UNIT 1: D.C. Network Theory-Circuit Theory Concepts – Mesh and Node Analysis; Network Theorems; Super-position, Thevenin, Norton and Max. Power Transfer Theorem, Star – Delta Transformation. 6(L)

UNIT 2: Steady State Analysis of AC Circuits- Sinusoidal and Phasor Representation of Voltage and Current, Single Phase AC circuit behavior of R, L & C, Combination of R, L & C in series and parallel, Resonance, Bandwidth and Quality Factor 8(L)

UNIT 3: Three-Phase A.C. Circuits-Line and phase voltage/current relationships for star and delta connection, Power measurement in 3-phase A.C. circuits.

Measuring Instruments: Construction & Principle of operation of voltage and current measuring instruments, Introduction to Wattmeters and Energy Meters. 6(L)

UNIT 4: Magnetic Circuits and Transformer:- Magnetic Circuits, Principle of Operation & Construction of 1φ transformer, Phasor diagram, Equivalent Circuit, O.C. and S.C. test, Efficiency and voltage Regulation 6(L)

UNIT 5 Introduction to Rotating Machines: Principle of Electromagnetic Energy Conversion; Types of d.c. machines, emf equation, magnetization and load characteristics, losses and efficiency of d.c. machines, Starting and speed control of d.c. motors, 3- φ induction motors - working principle and applications, 1- φ Induction motor - working principle and applications, Stepper motors. 8(L)

UNIT 6: Power Systems-Generation- Types of power Plant, Functional Block diagram of Generating stations (Hydel & Thermal Stations); Transmission- Standards (AC & DC), Substations, Grids; Distribution- Industrial, Commercial and Domestic Standards; Utilization- Types of loads, UPS and domestic inverters; Domestic Wiring- Materials, accessories & ratings of the wiring materials, types of wiring: fluorescent tube and simple domestic wiring layout, earthing rules.

Text/ Reference Books:

- I.V. Del Toro: Principle of Electrical Engineering, PHI, New Delhi.
- W.H.Hayt & J.E.kemmerly: Engineering Circuit analysis Mc Graw Hill New Delhi
- I.J.Nagrath: Basic Electrical Engineering, Tata Mc Graw Hill New Delhi
- W.D.Coper: Electronic Instruments & Measurement Technique, Prentice Hall India
- S.L.Uppal: Electrical Wiring, Estimating and Costing, Khanna Publishers Delhi.
- S.N.Singh; Electric Power Generation, Transmission and Distribution, PHI

SIGNALS AND SYSTEMS (EC-1302)

UNIT 1: SIGNALS AND THEIR REPRESENTATION-Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions, Eigen analysis, Hilbert spacesTypes of signals, Continuous-time and Discrete-time signals: Energy and Power signals, Periodic and Aperiodic signals, Even and Odd signals, Exponential and sinusoidal signals etc., Transformations of the independent variable, Concepts of Unit impulse and Unit sample signals, Signum function. Continuous-time and Discrete-time systems and basic system properties. MATLAB Exercises 10(L)

UNIT 2: LINEAR TIME-INVARIANT (LTI) SYSTEMS-Discrete and Continuous time LTI systems, convolution sum, convolution Integral, properties of LTI systems, causal LTI systems described by difference equations, Singularity functions. MATLAB Exercises. 4(L)

UNIT 3: FOURIER SERIES REPRESENTATION OF PERIODIC SIGNALS-Continuous-time and discrete-time signals and their Fourier series representation, properties of Fourier series, Dirichlet's conditions, Complex Fourier spectrum. MATLAB Exercises. 4(L)

UNIT 4: REPRESENTATION OF APERIODIC SIGNALS BY FOURIER TRANSFORMS-Continuous-time and discrete-time signals and their Fourier Transforms, Fourier Transforms of periodic signals and standard signals, properties of Fourier Transforms, System characterized by linear constant coefficient differential equation.MATLAB Exercises. 4(L)

UNIT 5: Z-TRANSFORMS-Principles of Z-Transform, definition, The Region of Convergence (ROC), properties of ROC, Relationship between Z-Transform and Fourier Transform, properties of Z-transform, Inverse Z-transform, pole zero plot, Power series expansion and partial fraction expansion, Initial value and Final value Theorems, Analysis and characterization of LTI system using Z-Transforms. MATLAB Exercises 7(L)

UNIT 6: SAMPLING-Representation of Continuous-time signals by its samples, Sampling theorem, Impulse train sampling, Sampling with Zero Order Hold (ZOH), Natural and Flat top sampling, Reconstruction of signal from it's samples using interpolation, Effect of under sampling – Aliasing, sampling of Band pass signals.Discrete time processing of continuous time signals, Digital differentiator, Half sample delay, Sampling of Discrete-time signals, Decimation and interpolation. MATLAB Exercises. 8(L)

UNIT 7: RANDAM SIGNALS-Review of probability theory, Random signals and their representation, Continuous and Discrete Random variable, their description and examples, Statistical averages. MATLAB Exercises 3(L)

Text/ Reference Books:

- Signals and Systems by A. V. Oppenheim, A. S Willsky, and S. H. Nawab, Prentice-Hall, Englewood Clieffs.
- Fundamentals of Signals and Systems by Michel J. Robert, MGH International Edition, 2008
- Signals and Systems by B. P. Lathi.
- Signals and Systems by Simon Haykin and Van Veen, Wiley, 2nd Edition.
- Probability, random variables and stochastic Processes by A. Papoulis, McGraw-Hill.

ELECTRONICS ENGINEERING (LAB) (EC-1351)

Experiment 1: Familiarization to basic test and measuring instruments like Cathode Ray Oscilloscope (CRO), Function Generator, Power supply, Breadboard etc.

Experiment 2: To measure the frequency and amplitude of various waveforms using CRO.

Experiment 3: To verify the truth tables of different logic gates by using ICs and implement different logic gates using IC 7400.

Experiment 4: To study the *pn* junction diode characteristics under forward and reverse bias conditions.

Experiment 5: To study the application of a zener diode as voltage regulator.

Experiment 6: To determine the ripple factor of Half-Wave and Full-wave (Bridge) rectifiers.

Experiment 7: To observe the clipping wave forms in different clipping configurations.

Experiment 8: To observe the clamping wave forms in different clamping configurations.

Experiment 9: To determine the CE (Common Emitter) characteristics of a given BJT.

Experiment 10: To plot the drain and transfer characteristics of a given FET and to find drain resistance.

Experiment 11: To verify the addition and subtraction operation using op-amp 741.

ELECTRICAL ENGINEERING AND MEASUREMENT (LAB) (EE-1352)

Experiment 1: Verification of circuit laws and theorems.

Experiment 2: Study of resonance in RLC circuits.

Experiment 3: Measurement of power in three phase-circuit using two-wattmeter method.

Experiment 4: Energy measurement of single-phase circuits.

Experiment 5: Open circuits and short circuits test on single-phase transformer.

Experiment 6: Load test on single phase transformer.

Experiment 7: Magnetization characteristic of d.c. generators.

Experiment 8: Starting and running of DC motor.

Experiment 9: Study of the characteristics of d.c. series motors.

Experiment 10: Speed control of DC motors using (a) Field Control (b) Armature Control

Experiment 11: Starting, running and reversing three phase squirrel cage induction motor.

DATA STRUCTURE (LAB) (EC-1353)

Experiment 1: Pointers Structures & its functions

Experiment 2: Arrays

Experiment 3: Link List

Experiment 4: Binary trees

Experiment 5: Sorting algorithres

ANALOG COMMUNICATION (EC-1401)

UNIT 1: Review of Signal Representations, Frequency domain analysis of signals using Fourier Transforms. Introduction to Communication systems, guided and unguided transmission media, radio frequency spectrum, Concept of bandwidth, Mathematical models for communication channels Linear filter channel, Linear time-invariant channel 4(L)

UNIT 2: Analog Signal Transmission and reception: Modulation, Amplitude Modulation: Equation or AM wave, Modulation Index and Power relationships. AM transmitter: Generation of AM. AM demodulator: Theory and Mathematical analysis of Square Low detector, Envelope detector and synchronous detector. AM demodulator: Theory and Mathematical analysis of Square Low detector, Envelope detector and synchronous detector. DSB AM: Principle of nonlinear resistance, Balance modulator and Switching Modulator DSB Demodulation through product modulator, Costas receiver. SSB AM: Time domain representation of SSB signal, Generation methods: Filter, Phase shift method using Hilbert Transformer, SSB demodulator. VSB-AM generation, Demodulation using sideband filters, Quadrature Carrier multiplexing, FDM with basic groups, super groups, mastergroups. 3(L)

UNIT 3: Frequency and phase modulation, NBFM, WBFM, Multiplexed Stereo FM system Generation of Frequency Modulation: Reactance modulator and Indirect method, Multiplexed Stereo FM system 4(L)

UNIT 4: Radio receivers: Tunned radio frequency receiver, Superheterodyne receiver Sensitivity and selectivity, selection of IF. Block diagram and features of Communication Receiver. 3(L)

UNIT 5: FM receiver: block diagram, FM discriminates: slope detector, balance slope detector and phase discriminator. 3(L)

UNIT 6: Noise in Communication Systems: Thermal noise, Shot noise, S/N ratio, noise Equivalent bandwidth,. Concept of Random Variables, PDF, CDF, Different types of Pdfs, Gaussian Rayleigh PDF, Noise performance of AM, DSB,SSB, FM systems under AWGN 3(L)

UNIT 7: Sampling Theorem, Analog Pulse modulation schemes PAM, PPM, PWM. Quantization Process, Quantization Error, Pulse Code Modulation, Line codes Differential pulse code modulation Delta modulation, adaptive delta modulation, Time division multiplexing (Analog and digital types) 4(L)

Text/ Reference Books:

- Communication System Engineering – John G Proakis
- Communication Systems- Simon Haykin
- Modern Digital and Analog Communication Systems- B.P. Lathi, 3rd edition, Oxford University Press, 1998.
- Principles of Communication Systems - Toab & Schilling
- Digital & Analog communication systems-K.S .Shanmugham
- Electronics Communication Systems - Roddy and Coolen
- Contemporary Communication Systems using Matlab- John G Proakis

DIGITAL ELECTRONICS (EC-1402)

UNIT 1: A brief review of Minimization Techniques. 2(L)

UNIT 2: COMBINATIONAL LOGIC: Introduction, Design Procedure, Adders, Subtractors, Code Converters, Magnitude Comparator, BCD to Seven Segment decoder, Parity generator and Checker, Decoders, Encoders, Multiplexers, Demultiplexers, ROMs, Design of the circuits using Decoders, Multiplexers, ROMs. 7(L)

UNIT 3: PROGRAMMABLE LOGIC DEVICES: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Design of the circuits using PLA and PAL, Field Programmable Gate Array (FPGA). 5(L)

UNIT 4: SEQUENTIAL LOGIC: Introduction, Flip-Flops, Flip-Flop Excitation Tables, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Race Around Condition, Master-Slave flip-flops, Conversion design of flip-flops. 4(L)

UNIT 5: Design of synchronous & ripple counters, Mod-k or Divide-by-k counters, Decade counter, BCD Counter, UP/DOWN Counters, Lock Out problem, Design with State Equations. 6(L)

UNIT 6: Shift register, Serial to Parallel Converter, Parallel to Serial Converter, Ring counters, Twisted-ring counter, Sequence Generator. 3(L)

UNIT 7: TIMING CIRCUITS: Multivibrators. 2(L)

UNIT 8: LOGIC FAMILIES: Characteristics of Digital ICs, DTL, TTL, ECL, MOS Logic & CMOS Logic, Calculation of noise margins and fan-out. 8(L)

UNIT 9: INTRODUCTION to VHDL: Basics, Simulation of Multiplexers, Demultiplexers etc 3(L)

Text/ Reference Books:

- M. Morris Mano: Digital Design, Third Edition, Prentice Hall
- R. P. Jain: Modern Digital Electronics, Third Edition, TMH
- Taub and Schilling: Digital Integrated Electronics, McGRAW HILL
- Sandige: Digital concept Using standard ICs
- R. J. Tocci: Digital Systems: Principles and Applications, Fourth Edition, Prentice Hall

NETWORKS AND SYSTEMS (EE-1404)

UNIT – I : Introduction: Network Classification and Characterization, Network Elements**,** Network Graph Theory-tree, Incidence matrix, cut set matrix, Tie set matrix**,** Analysis of Linear Time-Invariant Networks, Mesh and Nodal analysis. 6(L)

UNIT – II : Network Theorems: Super-position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's theorem. 8(L)

UNIT – III : Network Analysis: Initial conditions, Time domain analysis of RL, RC and RLC networks, Responses for unit step, ramp, square pulse and impulse function, Steady-state analysis of AC circuits: Sinusoidal and phasor representation of Voltage & current, single phase ac circuit behavior of R, L and C. Combinations. 8(L)

UNIT – IV: Circuit Analysis in s- domain: Concept of Complex frequency , Laplace transform and their application for circuit analysis, Network Functions-Transform Impedances Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot. 8(L)

UNIT –V: Two Port Networks: Characterization of two port networks. z, y, ABCD and h parameters, Reciprocity and Symmetry of two port network. Relationships between the parameters, inter-connections of two port networks. 5(L)
Unit – VI: Network Synthesis: Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms. 5(L)

Text/ Reference Books:

- M.E. Van Valkenberg, "Network Analysis" Prentice Hall
- M.E. Van Valkenberg, "Network Synthesis" Prentice Hall
- D. Roy Choudhary, "Networks & Systems" New Age-Publication
- W. H. Hayt & J. E. Kemmerly, "Engineering circuit Analysis", TMH
- A Chakrabarti & S. Bhadra, "Networks & Systems" Dhanpat Rai & Co.

ELECTROMAGNETIC THEORY (EC-1403)

UNIT 1: INTRODUCTION- Review of scalar and vector field, Vector representation of line, surface and volume integrals, Physical interpretation of gradient**,** divergence and curl, Divergence and Stokes theorem, Different coordinate systems. 4(L)
UNIT 2: ELECTROSTATIC FIELDS- Electric field due to point, surface and volume charges, Electrostatic potential for different charge distributions, Gauss's law and their applications, Solution of Laplace's and Poisson's equation in one dimension, Method of images applied to plane boundaries, Electric flux density, Boundary conditions, Capacitance, Electrostatic energy. 8(L)
UNIT 3: MAGNETOSTATIC FIELDS- Biot- Savart's law , Ampere's law, magnetic flux density, Boundary conditions, Faraday's law, Energy stored in magnetic field, Scalar and Vector Magnetic Potential. 8(L)
UNIT 4: TIME VARYING ELECTROMAGNETIC FIELDS-Continuity equation, Displacement current, Maxwell's equations in point form and integral form, Retarded vector potential, Plain wave equation and it's solution in conducting and non conducting mediums, Phase velocity, Group velocity, Plane waves in lossy dielectrics, Propagation in good conductors: skin effect, impedance of conducting medium, Polarization, Reflection and Refraction of plain waves at plain boundaries, Poynting Vector, Poynting theorem and power considerations. 8(L)
UNIT 5: TRANSMISSION LINES-Transmission line equations, parameters- primary and secondary constants, Analogy of transmission lines, Determination of α, β, γ and v_p ,characteristics impedance, Input impedance of a lossless line, open and short circuited lines, distortion-less lines, reflection coefficient and standing wave ratio, matched transmission line, Impedance matching, Smith chart and its applications. 8(L)
UNIT 6:COMPUTATIONAL ELECTROMAGNETICS-Finite element method (FEM) and Finite difference time domain method (FDTD) 4(L)

Text/ Reference Books:

- Hayt William., "Engineering Electromagnetics", Tata Mc Graw Hill
- Matthew N.O. *Sadiku* 'Elements of Electromagnetics' Oxford University Press
- Kraus J.D, "Electromagnetics" Tata Mc Graw Hill
- Complex Electromagnetic Problems and Numerical Simulation Approaches, Levent Sevgi, IEEE Press and John Wiley, New York, 2003.
- Jordan E.C. and Balmain K.G., "Electromagnetic waves and Radiating Systems"PHI
- Plonsey R. and Collin R.E., "Principles and Applications of Electromagnetic fields", Tata Mc Graw Hill.

ELECTRONIC DEVICES AND CIRCUITS (EC-1404)

UNIT 1: Bipolar Junction Transistor: Transistor switching characteristics, breakdown in Transistors, Ebers-Moll transistor equations, Analysis of transistor cutoff and saturation regions, small signal low frequency transistor hybrid model, simplified hybrid model, practical circuit of a transistor amplifier, effect of *Ce* and *Cc* on low frequency and high frequency response, high frequency model of a transistor-hybrid *pi* model. 12(L)
UNIT 2: JFET & MOSFET: Review of device structure operation and V-I characteristics. MOSFET as an Amplifier and switch, Biasing of MOSFET amplifier circuits, small-signal operation and models, single stage MOSFET amplifier, CS, CD and CG amplifiers, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier, Large signal analysis 8(L)
UNIT 3: Feedback amplifiers: Classification of amplifiers, Concept of feedback, transfer gain with feedback, General characteristics of negative feedback amplifiers, Effect of feedback on amplifier characteristics, Method of analysis of a feedback amplifier, Voltage-Series feedback, Current-Series feedback, Current-Shunt feedback, Voltage-Shunt feedback. 7(L)
UNIT 4: Oscillators: Basic principles of sinusoidal oscillators, Phase Shift oscillators, Resonant-Circuit oscillators, General form of an oscillator circuit (Hartley and Colpitts oscillators), Wien-bridge oscillator, Crystal oscillators, Frequency Stability. 7(L)
UNIT 5: Power amplifiers: Classification of power amplifiers, class A, AB, B and C power amplifiers and their efficiency, pushpull and complimentary Symetry amplifiers. 6(L)

Text/ Reference Books:

- Electronic circuits: Discrete and Integrated by D. L. Schilling, Charles Belove .
- Microelectronic Circuits by A. S. Sedra and K. C. Smith.
- Integrated Electronics by J. Milliman and C. C. Halkias
- Microelectronics by J. Milliman and A. Grabel

PRINCIPLES OF MANAGEMENT (HS-1401)

UNIT 1: Introduction to Management-Definition of Management – Science or Art – Management and Administration, Functions of Management – Types of Business Organization. Levels of management and Managerial skills 5(L)
UNIT 2: School of Management Thoughts: Evolution of Management thoughts, classical approach, neo- classical approach, contribution of Taylor, Weber and Fayol, modern approach. 6(L)

UNIT 3: Planning Nature & Purpose – Steps involved in Planning ,Objectives, Setting Objectives, Process of Managing by Objectives ,Strategies, Policies & Planning Premises Forecasting Decision-making. 8(L)
UNIT 4: Organizing Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process-Techniques-HRD-Managerial-Effectiveness. **Directing:** Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication. 11(L)
UNIT 5:Controlling-System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance. Coordination. 5(L)
UNIT 6: Organisational Behaviour- Organisational change, Conflict Management and Stress Management **Functional management:** Human Resource Management, Financial management, Marketing Management. 5(L)
Text/Reference Books:

- Tripathy PC and Reddy PN, "Principles of Management", Tata McGraw-Hill, 1999.
- Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996
- JAF Stomer, Freeman R. E and Daniel R Gilbert, "Management", Pearson Education, Sixth Edition, 2004.
- Fraidoon Mazda, "Engineering Management", Addison Wesley, 2000.
- Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill, 1998
- Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003

ANALOG COMMUNICATION (LAB) (EC-1451)
Experiment 1: To design and implement a Band Pass Filter for the range (400Hz-1KHz).
Experiment 2: To implement Amplitude Modulation (AM), demodulation and calculate the modulation index.
Experiment 3: To implement Frequency Modulation (FM) using IC 2206 and demodulation using IC 565.
Experiment 4: To implement Pulse Amplitude Modulation (PAM) and Demodulation.
Experiment 5: To implement Pulse Position Modulation (PPM).
Experiment 6: To implement Pulse Width Modulation (PWM).
Experiment 7: To implement Phase Locked Loop (PLL)and find out the lock range and capture range.
Experiment 8: To design and test the circuit of Voltage to Frequency Converter (VCO) using IC 555.
Experiment 9: To design and test a Mixer Circuit using PLL IC 565.
Experiment 10: To study and implement Pre-emphasis and De-emphasis circuits.
Experiment 11: To study and observe frequency response of Low-pass, High-pass, Band-pass and Notch filter using Spectrum Analyzer.
Experiment 12: To determine the spectrum of AM using spectrum analyzer.
Experiment 13: To determine the spectrum of FM using spectrum analyzer.
Experiment 14: To determine the performance of PCM.
Experiment 15: To determine the performance TDM (PAM) and TDM (PCM).

DIGITAL ELECTRONICS (LAB) (EC-1452)
Experiment 1: Verification of operation of Full Adder and Full Subtractor.
Experiment 2: Design & verification of 4-bit binary adder/subtractor using binary adder IC.
Experiment 3: Realization of operation of full adder and full subtractor using IC 74151/74153 MUX.
Experiment 4: Design & verification of full adder and full subtractor using an inverted output 3 to 8 line decoder.
Experiment 5: Design and verification of operation of a BCD Adder using IC 7483.
Experiment 6: Realization of 4 X 1 MUX using basic gates.
Experiment 7: Verification of operation of BCD to Seven segment code conversion using IC 7447.
Experiment 8: Verification of Truth Tables of SR & D Flip flops.
Experiment 9: Verification of Truth Tables of Master Slave JK Flip-Flop.
Experiment 10: Design of MOD-8 UP/Down synchronous counter.
Experiment 11: Design of BCD ripple counter.
Experiment 12: Design of Universal Shift Register.
Experiment 13: Design of a sequential circuit from given state diagram.
Experiment 14: Design and verification of Astable Multivibrator using IC 555.
Experiment 15: Design and verification of Monostable Multivibrator using IC 555.
Experiment 16: Implementation of Basic Combinational and sequential circuits using VSM (Virtual System Modelling)
Experiment 17: Implementation of Basic Combinational and sequential circuits using VHDL

ELECTRONIC DEVICES AND CIRCUITS (LAB) (EC-1453)
Experiment 1: To determine the quiescent operating conditions of fixed and self bias BJT Configurations
Experiment 2: Measurement of *h*-parameters of a BJT in CB, CE and CC configurations
Experiment 3: To plot the drain and transfer characteristics of a given FET and find the drain resistance, amplification factor and transconductance.
Experiment 4: To study the frequency response of an *RC* coupled amplifier and compute its bandwidth.
Experiment 5: To study the frequency response of a *CC* amplifier and compute its bandwidth
Experiment 6: To study the frequency response of a *CS FET* amplifier and compute its bandwidth
Experiment 7: To find the Gain and Bandwidth of a voltage series feedback amplifier.
Experiment 8: To find the Gain and Bandwidth of a current series feedback amplifier
Experiment 9: Study of RC-phase shift and Wien-Bridge oscillators.
Experiment 10: Study of Power amplifiers a) Class A power amplifier
b) Class B complementary symmetry power amplifier

VLSI TECHNOLOGY AND DEVICE MODELLING (EC-1501)

UNIT 1: Introduction to VLSI Technology: Classification of ICs, features of ICs , monolithic and hybrid ICs.
Crystal Growth and Wafer Preparation: silicon crystal growth from the melt, GaAs crystal growth techniques, crystal orientations, various defects in crystal, wafer preparation and wafer specifications. 6(L)
UNIT 2: Epitaxy: Epitaxy and its concepts, growth kinetics of epitaxy, vapour phase epitaxy, molecular beam epitaxy, silicon on insulator epitaxy.
Oxidation: Theory of growth of silicon dioxide layer, calculation of SiO_2 thickness and oxidation kinetics, dry, wet and high pressure oxidation, plasma oxidation, properties of oxidation, defects induced due to oxidation. 9(L)
UNIT 3: Lithography- Photolithography and pattern transfer, optical and electron photolithography, X-ray and ion-beam lithography. photoresist, types of photoresist, Etching- **d**ry & wet etching, basic regimes of plasma etching, reactive ion etching and its damages, sputter etching, merits and demerits of etching.
Diffusion Process- Diffusion models of solid, ficks theory of diffusion, diffusivities, measurement techniques, diffusion in polycrystalline silicon and silicon dioxide. 10(L)
UNIT 4: Ion implantation- Implantation equipments, high energy implantation, scattering phenomenon, range of implanted ions, implantation damage, annealing.
Metallization- Metallization applications, metallization choices, physical vapour deposition, patterning & problems in metallization. 9(L)
UNIT 5: Device Modelling &Simulation- Need and importance of semiconductor device simulators, understanding of poisson's and continuity equation for semiconductor device simulation, key elements of physical device simulation, second order effects, introduction to simulation tools. 4(L)

Text/Reference Books:

- VLSI Technology – S M Sze, McGraw Hill, 2nd Ed.
- VLSI Fabrication Principles – S.K Gandhi, Wiley, 2nd Ed.
- The Science & Engineering of Microelectronic Fabrication – Stephen A Campbell, 2nd Oxford University Press.

MICROPROCESSORS AND ITS APPLICATIONS (EC-1502)

Unit 1: (a) Introduction: Evolution of Microprocessors and Microcomputers, Bus Organization, Bus Contention, Standard Bus Drivers & Transceivers, 3-State Buffers & Latches. 2(L)
(b) Architecture of a 8-bit Microprocessor: Internal organization of 8085, Signal descriptions, Machine Cycles & Timing diagrams, CPU Module Organization 4(L)
Unit 2: (a) Assembly Language Programming: Data Addressing modes, Instruction Set and Programming. 5(L)
(b) Special Architectural Features: Organization of Stack, Interrupts Structure, Interrupt Programming. 4(L)
Unit 3: (a) Basic Interfacing: Memory interfacing, Programmable Peripheral Interface (8255), Programmable Interval Timer (8253/8254) and Operating Modes, Minimum 8085 System Configuration with 8355/8755. 6(L)
(b) Direct Memory Access: Basic DMA operations and timings, 8257 Programmable DMA Controller and its interfacing. 2(L)
Unit 4: (a) Architecture of a 16-bit Microprocessor: Internal organization of 8086, Signal descriptions, Physical memory organization, BIU, EU, Bus Organization and Timing, Addressing modes, Instruction Set, Assembler directives. 8(L)
(b) Special Architectural Features: Minimum & Maximum Mode of Operation, 8288 Bus Controller, Interrupt Vector Table, The IRET instruction, Writing ISRs, Interrupts due to Errors. 5(L)
Unit 5: Exemplary System Design: Interfacing A/D and D/A converters and Measurement of Physical & Electrical Quantities, Waveform Generators, Design of Digital IC Tester, Security System, Process Monitoring/Control System. 4(L)

Text/Reference Books:

- Ramesh S. Gaonkar, "Microprocessors: Architecture Programming and applications with 8085".
- Microprocessor and Interfacing - D. V. Hal
- Microprocessor System: The 8086/8088 family- Liu and Gibson
- The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, Pentium, and Pentium Pro Processor – B. B. Brey.

ANTENNA AND WAVE PROPAGATION (EC-1503)

UNIT 1: **Electromagnetic Radiation and Antenna Fundamentals**-Review of Maxwell's equations: Retarded vector potential, Solution of wave equation in retarded case, Concept of radiation, Antenna equivalent circuits, Antenna characteristics: Radiation pattern, Beam solid angle, Radiation intensity, Directivity, Gain, Input impedance, Polarization, Bandwidth, Effective aperture, Antenna effective height, Antenna temperature. 8(L)
UNIT 2: Wire Antenna and Antenna Arrays-Wire antennas: Hertizian dipole , Short dipole, Radiation resistance and Directivity, Half wave Dipole, Monopole, Small loop antennas. Antenna Arrays: Linear Array and Pattern Multiplication, Two-element Array, Uniform Array, Array with non-uniform Excitation, Binomial Array. 8(L)
UNIT 3: Apurture Antennas-Aperture Antennas: Slot antenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector, Corner Reflector, Common curved reflector shapes, parabolic reflector, Lens Antenna. 8(L)
UNIT 4:Special and Broad band Antennas-Special Antennas: Long wire, V and Rhombic Antenna, Yagi-Uda Antenna, Turnstile Antenna, Helical Antenna- Axial and Normal mode helix, Bi-conical Antenna, Frequency Independent Antenna, Log periodic Dipole Array, Spiral Antenna, Microstrip Patch Antennas. 8(L)
UNIT 5: Radio Wave Propagation-Ground Wave Propagation, Free-space Propagation, Ground Reflection, Surface waves, Diffraction, Wave propagation in complex Environments, Tropospheric Propagation, Space waves, Ionospheric propagation: Structure of ionosphere, Sky waves, Skip distance, Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Effects of earth's magnetic fields, Faraday rotation. 8(L)

Text/Reference Books:

- John D.Kraus, "Antennas ", Tata McGraw-Hill .
- G.S.N.Raju, "Antenna Wave Propagation", Pearson Education,
- Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley and Sons

- E.C.Jordan and Balmain, "Electromagnetic waves and Radiating Systems", Pearson Education
- A.R.Harish, M.Sachidanada, "Antennas and Wave propagation", Oxford University Press,
- W.L Stutzman and G.A. Thiele, "Antenna analysis and design", John Wiley and Sons

ELECTRONIC CIRCUIT DESIGN (EC-1504)

UNIT 1: Single Stage Integrated Circuit Amplifiers: IC Biasing (Current Source, Current Mirrors and Current – Steering circuit), Common source and Common Emitter Amplifier with active load, Common Gate and Common Base amplifier with active load, Cascode amplifier. CMOS Current mirror, CS, CD & CG Amplifier & their frequency response, Bipolar Current mirrors. 14(L)

UNIT 2: Differential and Multistage Amplifier: BJT Differential Pair, Block diagram of MOS Differential Pair, Differential Amplifier with active load, Multistage Amplifier 2(L)

UNIT 3: Operational Amplifier and its Applications: Internal Architecture, Bipolar Op-Amp circuit, JFET Operational amplifier circuit, CMOS operational amplifier circuit, Measurement of OP-Amp parameter, Frequency response and compensation, Inverting and Non inverting amplifier, Difference amplifier, Instrumentation amplifier, Precision Rectifier, Schmitt Trigger, Sine Wave generator, Triangular wave generator, Log and Antilog amplifier 6(L)

UNIT 4: Active Filter Circuit: Comparison of active and passive filter, Design of Low pass, High pass, Band pass, band stop and all pass active filter, Switched Capacitor Circuits: Basic building blocks, Basic operation and analysis, Bi-quad filter, Switched capacitor filter. 4(L)

UNIT 5: Timer Circuit: Internal architecture of 555 timer, 555 timer as Mono-stable and Astable multivibrator, voltage to frequency converter using 555 timer. 3(L)

UNIT 6: Phase Locked Loop: Basic architecture, PLL operation, and application. 2(L)

UNIT 7: Instrumentation: Data Acquisition system, telemetry, Transducers and its various types, Instruments types and performance characteristics, static and dynamic characteristics of instruments, Digital meters, AC Bridge. 5(L)

UNIT 8: Information Distribution System: Digital design in space domain, time domain, serial & pipeline organization. 2(L)

Text/Reference Books:

- Design of Analog CMOS Integrated circuits- Behzad Razavi-TMH.
- Digital Integrated circuits- J.M Rabaey- PHI.
- CMOS Analog Circuit Design- 2nd Edition – Phillip E. Allen, Douglas R. Holberg – Oxford Uni. Press.
- Analysis and Design of Analog Integrated Circuits- 4th Edition – Gray, Hurst, Lewis, Mayer- Wiley.
- Microelectronic Circuits Theory and Applications- 5th Edition- Adel S. Sedra, Kenneth C. Smith- Oxford Uni. Press.

DIGITAL COMMUNICATION (EC-1505)

UNIT 1: Introduction to digital communication systems: Principles of digital data transmission. 2(L)

UNIT 2: Information and channel capacity, Entropy , Discrete and Continuous channels, BSC, Source coding theorem, Fano and Huffman's coding, Lempel-Ziv Source coding , Rate Distortion Theory ,Differential Entropy, Rate distortion Function, Shannon's Channel capacity theorem, Trading bandwidth for S/N etc. Shannon's limit. Performance of digital communication system. 5(L)

UNIT 3: Baseband data transmission systems, Error probability, ISI, pulse shaping, matched filters, M-ary signalling schemes, Equalization. Symbol synchronization. Gram-Schmitt orthogonalization,Two Dimensional Signal Waveform,Two Dimensional Bandpass Signals, orthonormal Basis functions 6(L)

UNIT 4: Digital modulation schemes, ASK, PSK, QPSK, DPSK, GMSK, FSK and QAM systems,Probability of error of each scheme, Matched filter receiver and its characteristics and Implementation, Signal space representation of digital modulation systems, Phase Trellis, Probability of error in digital modulation schemes under AWGN environment, continuous phase carrier modulation 13(L)

UNIT 5: Digital transmission, Fading on multipath channels, Performance comparison of various digital modulation schemes. 3(L)

UNIT 6: Error control coding, Hamming distance, Linear block codes, Cyclic codes, Convolution codes, Code generation and detection methods, Viterbi coding and decoding practical applications of coding,the trellis diagram of viterbi decoding, Wavefrom coding. 7(L)

UNIT 7: Linear predictive coding, Subband coding Adaptive transform coding, Digital audio transmission and Digital Audio recording. 4(L)

Text/Reference Books:

- John Proakis, Digital Communications
- K.S. Shammugham, Digital & Analog Communication Systems –
- Simon Haykin, Communication Systems, 4th ed., John Wiley & Sons, 2001.
- B.P. Lathi, Modern Digital and Analog Communication Systems", 3rd edition, Oxford University Press, 1998.
- P. Chakravarti, Principles of Digital Communication
- M.S. Roden, Digital Communication System Design
- M. Rice, Digital Communications - A Discrete-Time Approach, Prentice-Hall, 2009.
- B. Sklar, Digital Communications: Fundamentals & Applications, 2nd ed., Prentice Hall, 2001.

AUTOMATIC CONTROL SYSTEMS (EE-1505)

UNIT 1: System Modeling and Closed Loop System-Introduction, Classification based on differential equations, Modeling of various physical systems, Open-loop and Closed-loop control, Transfer Functions, Block diagram representations, disturbance rejection, Block diagram reduction rules, Signal flow graph and Mason's gain formula 9(L)

UNTI 2: Time Response Analysis: Various standard test signals, Time response of first order and second order systems, Second order design specifications, Steady state error analysis, dominant poles 8(L)

UNIT 3: Stability and Root locus plot: Concept of stability, Routh-Hurwitz criteria, Critical stability, Root locus plots, Rules for plotting root-locus. 5(L)

UNIT 4: Frequency Response Analysis: Frequency response of linear systems, Bode plots, Polar plots, Nyquist stability criteria, Gain margin and phase margin. 7(L)

UNIT 5: Compensator design and controllers-PID-controllers, Compensator design using root locus and bode plots, Lead, lag and lag-lead compensators 5(L)

UNIT 6:State-Space Analysis-State-space representations, Similarity transformation, Conversion from SS to transfer function, Solution of state equation, Controllability and Observability, Pole-placement and Observer design 6(L)

Text/Reference Books:

- K. Ogata, Modern Control Engineering, Prentice Hall, Inc., Englewood Cliffs, N.J., 5th ed., 2001.
- I. J Nagrath and M. Gopal, Control Systems Engineering, New Age International Pub., 4th ed., New Delhi, 2006.
- B. C. Kuo, Automatic Control System, Prentice-Hall, N.J., 7th ed., 1995.
- R. T Stefani, B. Shahian, J. Savant, Jr., G. H. Hostetter, Design of Feedback Control System, Oxford Univ. Press, New York, 2002.
- R. C Dorf and R. H. Bishop, Modern Control System, Addison-Wesley Longman, Inc., USA, Reprint India 1999.

MICROPROCESSORS (LAB) (EC-1551)

(A) 8085 Based Experiments

Experiment 1: Familiarization with SDK-85

a. Decoding, Storing and Executing programs in SDK-85 trainer kit: Register Addition, Indirect Subtraction and Immediate Add with Carry.

b. Use of RST 5 in SDK-85 and obtaining PSW Status at the end of execution.

Experiment 2: Write a program to ADD/ SUBTRACT two 16-bit numbers stored in memory.

Experiment 3: Write a program to ADD/ SUBTRACT two BCD numbers stored in memory.

Experiment 4: Write a program to search a data from a given table.

Experiment 5: Write a program to find out Smallest/Largest data from a table.

Experiment 6: Write a program to sort out a table in Ascending/Descending order.

Experiment 7: By using a Lookup Table stored in memory write a program to find out

a. ASCII code of a hexadecimal integer from a look table.

b. Hexadecimal integer corresponding to given ASCII code.

Experiment 8: Write a program to multiply two 8-bit numbers; result may be 16-bits.

Experiment 9: Write a program to divide two numbers.

Experiment 10: Study and verification of interrupts: (i) RST 7.5 and (ii) RST 7.

Experiment 11: Write a program to count and display the number of hardware interrupt requests that arrived in 5 seconds, using on-board display routines of SDK-85.

(B) Interfacing Experiments

Experiment 12: Study & verification of Mode 0 operation and BSR mode operation of 8255.

Experiment 13: Study & verification of various operating modes of PIT 8253/8254 by

Experiment 14: By using the PIT 8253/8254 Timer IC write a subroutine to verify the (i) Mode 0 operation, (ii) Mode 1 operation and (iii) Mode 3 operation.

Experiment 15: Study of Microprocessor Applications.

a) Study & verify traffic light control system.
b) Study & verify the interfacing of a Hex-pad.
c) Study & verify the interfacing of keyboard.
d) Study & verify the elevator system via simulator.
e) Study & verify the interfacing of thumbwheel control.

(C) 8086 Based Experiments

Experiment 16: Basic Assembly Language Programming

a) Write a program to add two 16-bit numbers stored in Data Segment.
b) Write a program to count odd numbers and even numbers in table stored in Data Segment.
c) Write a program to ADD/ SUBTRACT two BCD numbers, stored in Data Segment, via BCD instructions.

Experiment 17: Write a program to

a) ADD a series of 16-bit numbers stored in Data Segment via LEA.
b) Find out square of an integer from a look table via XLAT.

Experiment 18: Write a program to fill a given character in a table stored in Data Segment.

Experiment 19: Given the two ASCII coded integers stored in Extra Segment, write a program to (i) ADD and (ii) Multiply these two ASCII coded integers.

ELECTRONIC CIRCUIT DESIGN (LAB) (EC-1552)

Experiment 1: To design a comparator circuit and study the non-linear applications of Op- Amp.
Experiment 2: To design and test the Schmitt Trigger for the given UTP and LTP using IC 741 Op-Amp.
Experiment 3: To design a circuit and study the following waveform generators using IC 741 Op-Amp.
(a) Sine wave generator.
(b) Square wave generator.
(c) Triangular wave generator.
(d) Sawtooth wave Generator.
Experiment 4: To design and test the following circuits using IC-555
(a) Astable Multivibrator.
(b) Monostable Multivibrator.
(c) Voltage to Frequency converter.
(c) Schmitt Trigger.
Experiment 5: To design Voltage Limiter circuit and Precision rectifier using IC741 Op-Amp.
Experiment 6: To design and study the circuit of a voltage to frequency converter using IC741Op-Amp.
Experiment 7: To design and study the performance of an Instrumentation amplifier.
Experiment 8: To design an integrator and differentiator using IC 741 Op-Amp.
Experiment 9: To design a band pass filter and notch filter using IC 741 Op-Amp.
Experiment 10: To design and test a 2nd order low pass filter and high pass filter using IC 741 Op-Amp.

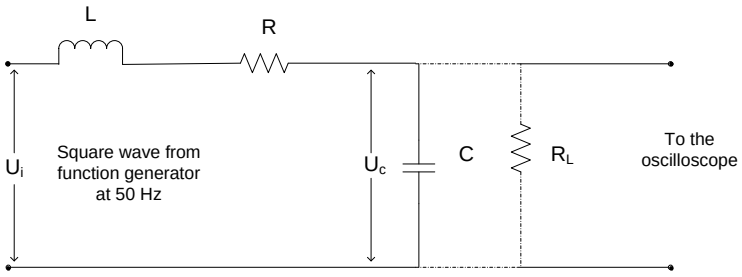
DIGITAL COMMUNICATION (LAB) (EC-1553)

Experiment 1: To perform the generation of Pseudo Random Binary sequence and determine the chip rate using PN sequence.
Experiment 2: To perform PCM generation and demodulation.
Experiment 3: To perform Amplitude Shift Keying (ASK) modulation and demodulation
Experiment 4: To perform Binary-Frequency Shift Keying (B-FSK) modulation and demodulation.
Experiment 5: To perform Binary-Phase Shift Keying (B-PSK) modulation.
Experiment 6: To study and implement Digital Phase Detector and to detect the phase difference between two sinusoidal waves.
Experiment 7: To study and implement Frequency Synthesizer.
Experiment 8: To test the various AT commands on GSM Evaluation Kit for IMSI Information along with performing basic implementation of GSM based Mobile Phone Kit.
Experiment 9: To study and perform basic implementation of CDMA (DSSS) on CDMA Evaluation Kit.
Experiment 10: To study and implement TDM based experiments related to various modulation schemes on Evaluation Kit.

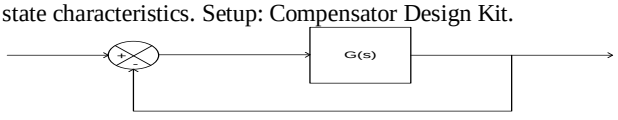
AUTOMATIC CONTROL SYSTEMS LAB (EC-1554)

Experiment 1: Determine the transfer function of a separately excited DC generator.
Experiment 2: Obtain the frequency response characteristics of the first and second order active LPF.
Experiment 3: Obtain the graph between output errors and angular position difference of a given potentiometer error detector.
When the excitation is DC.
When the excitation is AC.
Experiment 4: Determine the time response of different order of system using linear system simulator.
(a) Determine the time constant of first order system for open loop system
(b) Determine the time constant of type-1 system for closed loop system.
Experiment 5: Determine the frequency response of given open loop linear system and time response of closed loop system.
Experiment 6: Obtain the frequency response of LAG and LEAD Compensator.
Experiment 7: To draw the frequency response of a given L,R,C network theoretically and to capture the time response for a given square wave input at 50Hz (power supply).
Draw the bode plot for

$$\frac{Vc}{Vi} = \frac{1}{LCs^2 + RCs + 1}$$



Design L, C, R such that 50Hz or 314 rad/sec comes in the pass band.
Experiment 8: Use designed Lag and Lead compensator (Experiment No. 6) with the given closed loop system and show that the lead compensator improves transient performance and lag compensator improves the steady state characteristics. Setup: Compensator Design Kit.



Experiment 9: MATLAB based experiments.

DIGITAL SIGNAL PROCESSING (EC-1601)

UNIT 1: Introduction, Overview of Digital Signal Processing 1(L)

UNIT 2: Discrete Time Signals: Introduction, Classification of Signals, Simple Manipulations on discrete time signals, Sampling and Reconstruction of signals. 2(L)

UNIT 3: Discrete Systems: Representation of Systems, Properties of DSP systems, Difference equation and its relationship with system function, Impulse response and frequency response. 2(L)

UNIT 4: Discrete time Fourier analysis: Introduction, Discrete Time Fourier Transform and its properties, Frequency domain representation of LTI systems. 2(L)

UNIT 5: Z-Transform: Introduction, Unilateral and Bilateral Z-Transform and its properties, Inverse Z-Transform, System representation. 4(L)

UNIT 6: The Discrete and Fast Fourier Transform: Introduction, Discrete Fourier Series, DFT and its properties, linear convolution using DFT, Computation of an IDFT, Various algorithm for FFT computation. 6(L)

UNIT 7: Realization of digital linear systems: Introduction, Basic Realization, Block diagram representation and signal flow graph, Basic structures for IIR and FIR systems. 4(L)

UNIT 8: Infinite Impulse Response (IIR) Filters: Introduction, Filter design by approximation of derivatives, impulse invariance method, bilinear transformations, Design of Butterworth, Chebyshev, Inverse Chebyshev filters, Frequency transformation 4(L)

UNIT 9: Infinite Impulse Response (IIR) Filters: Introduction, Filter design by approximation of derivatives, impulse invariance method, bilinear transformations, Design of Butterworth, Chebyshev, Inverse Chebyshev filters, Frequency transformation 4(L)

UNIT 10: Finite Impulse Response (FIR) Filters: Introduction, Frequency response of linear phase FIR filters, Design techniques of FIR filters. 4(L)

UNIT 11: Effect of Finite Word Length in Digital Filters: Introduction, Rounding & Truncation errors, quantization effects in analog to digital conversion of signals, Limit cycle oscillations. 4(L)

UNIT 12: Multirate Digital Signal Processing: Introduction, Sampling Rate Conversion, Filter Structures, Polyphase Decomposition 3(L)

UNIT 13: Introduction to Homomorphic signal processing 2(L)

UNIT 14: Applications of Digital Signal Processing 2(L)

Text/Reference Books:

- Discrete-time Signal Processing - A.V. Oppentiem and R.W. Schafer
- Digital Signal Processing - A.V. Oppentiem and R.W. Schafer
- Signals and Systems - A.V. Oppenheim, A.S. Willsky, and I.T. Young.
- Digital Signal Processing: Principles, Algorithms, and Applications by J. G. Proakis and D. G. Manolakis.
- Multirate Digital Signal Processing by R. E. Crochiere and L. R. Rabiner.

RF AND MICROWAVE ENGINEERING (EC-1602)

UNIT 1: Introduction-Microwave frequencies, Standard Frequency bands, Behaviour of circuits at Conventional and microwave frequencies, Microwave applications. 4(L)

UNIT 2: Waveguide-Review of Rectangular waveguide, Circular Waveguides. Solution of wave equation in cylindrical co-ordinates, Derivation of field equations for TE & TM modes, degenerate and dominant mode, Power Transmission and Power loss, Excitation of waveguides, Cavity Resonator. 8(L)

UNIT 3: Microwave Passive Components-Scattering matrix -Concept of N port Scattering matrix representation Properties of S matrix- S matrix formulation of two-port junction. Microwave junctions -Tee junctions E-Plane Tee, H-Plane Tee and Magic Tee , Rat race, Corners , bends and twists , Directional couplers -two hole directional couplers-Ferrites - important microwave properties and applications, Isolator, Circulator , Attenuator , Phase shifter. 8(L)

UNIT 4: Microwave Semiconductor Devices-Principles of operation - characteristics and application of tunnel diodes, PIN diode and LSA. Transferred Electron Devices -Gunn diode- Avalanche Transit time devices IMPATT and TRAPAT. Parametric devices -Principles of operation - applications of parametric amplifier. 8(L)

UNIT 5: Microwave tubes: Limitations of conventional tubes in the microwave frequency range, O-type and M-type tubes. Klystron amplifier, Reflex Klystron oscillator, Magnetron, Traveling wave tube. 8(L)

UNIT 6: Microwave measurements: Microwave test bench, Measurement of power, wavelength, frequency, impedance, SWR, attenuation and phase shift. 4(L)

Text/Reference Books:

- Samuel Y Liao, "Microwave Devices & Circuits" , Prentice Hall of India,
- D.M.Pozar, "Microwave Engineering.", John Wiley & sons, Inc.,
- Robert. E.Collin-"Foundation of Microwave Engineering" –Tata Mc Graw Hill.
- Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw-Hill Inc.
- M.M.Radmanesh , "RF & Microwave Electronics Illustrated", Pearson Education, 2007.
- Robert E.Colin, "Foundations for Microwave Engineering", Tata McGraw Hill,

DATA COMMUNICATION AND NETWORKS (EC-1603)

UNIT 1: Introduction: Data Communications, Networks, The Internet, Protocols and Standards, Network Models, Layered Architecture, The OSI Model, Layers in the OSI Model, TCP/IP Protocol Sutite, ATM-reference model, Addressing, Physical Layer and Transmission Media, Switching: circuit switching, packet switching, message switching, ATM switching, Switch fabrics for fast switching. 8(L)

UNIT 2: Bandwidth utilization: Multiplexing and Spreading, Multiplexing, Spread Spectrum, Transmission Media, Guided Media, Unguided Media, Wireless, Switching, Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Structure of a Switch, Using Telephone and Cable Networks for Data Transmission, Telephone Networks, Dial-up Modems, Digital Subscriber Line, Cable TV Networks, Cable TV for Data Transfer, Different PCM, TDM transmission standards. Multiple Access Techniques. 8(L)

UNIT 3: Data Link Control, Framing, Flow and Error Control, Protocols, Noiseless Channels, HDLC, Point-to-Point Protocol, Multiple Access, Random Access, Aloha, Controlled Access, Channelization, MAC Level IEEE Standards, Standard Ethernet, Changes in the Standard, Fast Ethernet, Gigabit Ethernet, IEEE 802.11, Bluetooth. 6(L)

UNIT 4: Connecting LANs, Backbone Networks and Virtual LANs, Connecting Devices, Backbone Networks, Virtual LANs, Cellular Telephony, Satellite Networks, Sonet/SDH, Architecture, Sonet Layers, Sonet Frames, STS Multiplexing, Sonet Networks, Virtual Tributaries, Virtual-Circuit Networks: Frame Relay and ATM, Frame Relay, ATM, ATM LANs. 6(L)

UNIT 5: Networks Layer: Logical Addressing, IPv4 Addresses, IPv6 Addresses, Network Layer: Internet Protocol, Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6, Network Layer: Address Mapping, Error Reporting, Forwarding and Routing, Unicast Routing Protocols. 7(L)

UNIT 6: Transport Layer: Process-Process Delivery UDP, TCP and SCTP, Process-to-Process Delivery, User Datagram Protocol (UDP), TCP, Congestion Control and Quality of Service, Data Traffic, Congestion, Congestion Control, Two Examples, Quality Service, Techniques to improve QoS, Integrated Services, Differentiated Services, QoS in Switched Networks wireless TCP. 5(L)

Text/Reference Books:

- Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan, TMH.
- Computer Networks, A.S. Tanenbaum, 4th edition, Pearson education.
- Introduction to Data communications and Networking, W.Tomasi, Pearson education.
- Data and Computer Communications, G.S. Hura and M. Singhal, CRC Press, Taylor and Francis Group.
- An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education.
- Computer Networks, L.L. Peterson and B.S. Davie, 4th edition ELSEVIER.
- Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kurose, K.W. Rose, 3rd Edition, Pearson Education.
- Data and Computer Communications, William Stallings, Prentice Hall.
- Data Communications, Computer Networks, and Open Systems, F. Halsall, Addison-Wesley.

OPTICAL COMMUNICATION (EC-1604)

UNIT 1: Optical evolution and fiber optics-

- Optical evolution, advantages of optical communication, its representations 1(L)
- Optical waveguides, basic optical laws, acceptance angle, numerical aperture Skew rays 3(L)
- Rays and modes, step-index, graded-index fibers, phase and group velocities 3(L)
- Signal degradation in optical fibers, attenuation units, absorption, scattering Disspersions 3(L)
- Optical amplifiers 1(L)

UNIT 2: Optical sources and communication-

- Optical sources, modulators, transmitted optical fields, optical field expansion 3(L)
- Photo detection processes, count statistics, photo counting with receiver fields, photo counting with random photo multiplication 3(L)
- Shot noise processes, PSD of shot noise 2(L)
- Coherent and Non-coherent detection, system model, single mode and multi mode detection, SNR performance 5(L)
- AM/IM, FM/IM systems 2(L)
- Multiplexed FM/IM systems, heterodyne SNRs 2(L)

UNIT 3: Optical digital communication-

- Optical digital communications, heterodyne ASK, FSK, PSK, Systems, PLL Loop receiver and their noise performancesb 8(L)
- WDM, optical link design 2(L)
- Optical networks (SONET) 2(L)

Text/Reference Books:

- Optical Fiber Communications(3rd edition)- Gerd keiser
- Optical Fiber Communications -John M Senior
- Optical Fiber Communications -Robert .Gagliardi, Sherman Karp
- Principles of light wave communications-Goran Einarsson

MICROELECTRONICS AND VLSI DESIGN (EC-1605)

UNIT 1: Basic Electrical Properties - NMOS Inverter, Z_{pu}/Z_{pd} ratio, CMOS Inverter, Regions of Operation, BiCMOS Inverters. 6(L)

UNIT 2: Basic Circuit concepts & Characterization- Sheet Resistance, Standard unit of capacitance, delay unit, switching characteristics, Inverter delay, propagation delay, power dissipation. 6(L)

UNIT 3: Scaling - Scaling models and factors, scaling factors for various device parameters, limits due to sub-threshold currents, limits on logic levels & supply voltages due to noise, limits due to current density. 8(L)

UNIT 4: MOS Circuits and logic design: Switching logic, gate logic, Two/Three input NMOS,CMOS & BiCMOS, NAND & NOR gates, CMOS logic structures, clocked and sequential circuits, design processes, single bit adder, Bit-parallel adder, Carry Look-ahead adder. 12(L)

UNIT 5: Testability: Test Principles, DFT Principles, design strategies, IDDQ testing. 6(L)

Text/Reference Books:

- Basic VLSI Design – By - 'Pucknell & Kamran Eshraghian'.
- Principles of CMOS VLSI Design – By ' Neil H.E Weste & Kamran Eshraghian'

COMPUTER ARCHITECTURE (EC-1606)

UNIT 1: Data Representation- Sign magnitude representation, Fixed point number and its representation, Floating point number and its representation, IEEE standards. 2(L)

UNIT 2: Central processing Unit- CPU Architecture and functions, Type of operands and instructions , Addressing modes, and formats, Instruction cycles, Fixed point arithmetic , multiplication algorithms , Booths algorithm, hardware implementation, Division algorithm, Floating point arithmetic. 8(L)

UNIT 3: Control Units-Design methodology (processor level, register level and gate level design), Register Transfer and Micro orations, Hardwired and Micro Programmed control unit design concept, Microprogramming. 6(L)

UNIT 4: Memory- Internal memory, Characteristics of memory systems, memory hierarchy, Main memory organization, cache memory, organization, mapping, replacement algorithms, Pentium cache organization, Performance Characteristics, Associative memories, Virtual memory implementation. Secondary storage. 10(L)

UNIT 5: Peripheral Devices- Programmed I/O, Interrupt driven I/O, I/O controller, DMA controller, Device drivers, Peripheral devices and their characteristics: Printer, Keyboards. 4(L)

UNIT 6: Bus architectures- Uni-bus and multi-bus architectures. 2(L)

UNIT 7: Introduction of Parallel processing and pipeline processing. 4(L)

Text/Reference Books:

- Mano Moris, , " Computer system Architecture", PHI
- John P. Hayes, " Computer Architecture and Organization" McGraw hill
- Hamacher, " Computer Organization", McGraw hill.
- Tennenbaum," Structured Computer Organization", PHI
- B. Ram, "Computer Fundamentals architecture and organization", New age international
- Gear C. W., "Computer Organization and Programming", McGraw hill
- William Stalling, Computer Organization and Architecture, PHI fourth edition.

COMMUNICATION SKILL WORKSHOP (HS-1601)

Experiment 1: Art of communication: What is communication, good communication and effective communication, barriers and filters, activity on barriers and filters.

Experiment 2: Body language: verbal and non –verbal behavior interpretation, activity on non-verbal communication.

Experiment 3: Active listening. Active listening quiz.

Experiment 4: Feedback: How to give and receive feedback, Activity on feedback.

Experiment 5: Hidden date of communication: Feelings. Activity on how to handale feelings.

Experiment 6: Practical skills: assertiveness, activity on assertiveness, self-confidence, activity.

Experiment 7: In the world of teams: the team concept, element of teamwork. Team formation, effective team, exercise on team, Team players, activity.

Experiment 8: Discussions, decisions and presentations: Structured and un-structured group discussions. Activity on each.

Experiment 9: Adapting to Corporate life: exercise on grooming and dressing, getting ready for interview.

Experiment 10: Business Etiquette/Dining etiquette.

DIGITAL SIGNAL PROCESSING (LAB) (EC-1651)

Experiment 1: Plot the following function

h(n)=4rncos[πn(1+r)/M]+Msin[πn(1-r)/M]/[1-(4rn/M)^2]πnM

h(0)=1/M+r/M(4/π-1)

h(±M/4r)=-r/M[2 cos(π/4r(1+r)-cosπ(1-r)/4r] for M=4, r=0.1

Experiment 2: Generate Gaussian number with mean=20 and variance=40. Plot probability Density function of the generated numbers

Experiment 3: Generate Gaussian number with mean=0 and variance=1. Plot the Generated Numbers and calculate third moment i.e. skew-ness using

$$\text{Skew}(x1,x2\ \ldots\ldots xn)=1/N\sum_{j=1}^{N}[(xj-\text{mean})/(\text{variance})]\text{^}3$$

Experiment 4: Generate Gaussian distributed number and uniform distributed number and Find the correlation between them.

Experiment 5: Plot the following function unit sample sequence u(n) ,Ramp sequence n u(n)**.** Also down sample each of the above sequences

Experiment 6: Write the program to generate the signal corrupted by the noise d(n), Resulting S(n) is ……..

X(n)= S(n)+d(n)
S(n)= 2n (0.8)^n
Also down sample the sequence

Experiment 7: Write a program to develop a signal y[n] generated by a convolution of two sequences x[n] and h[n], where x[n]=[-2 ,1 , -1, +2, -0.5] and h[n] =[0,2,0 -1 , 1 ,0] Verify by using convolution theorem.

Experiment 8: Plot the following expression of H(z) in z-plane

(a.) H(z) =2+9z^-1+18z^-2+48z^-3/(3+3z^-1+15z^-2-12z^-3)
(b.) H(z) =5-9z^-1+16z^-2-14z^-3/(1-2z^-1+10z^-2+6z^-4+64z^-5)

Experiment 9: A LTI system is given by

y[n]+0.75y[n-1]-0.48y[n-2]-0.9y[n-3]=0.58x[n]+0.95x[n-1]+0.49x[n-2]+x[n-3]
Write a program to compute and plot the impulse response of the system.

Experiment 10: Write a program to determine the m-point DFT the following n-point

Sequence X[n] = n , 0<n<N-1
= 0 other wise Take N=16, M=32

Experiment 11: Write a program to compute IDFT of n-point sequence given by

X[k] = k/N ; 0 < k < N-1
= 0 ; otherwise

Note: - Do not use IFFT/FFT function of mat lab.

Experiment 12: Determine the factor form of the following Z –transform:

(a): G(z) =[2z^4 + 7z^3+ 48 z^2 + 56z] /[32z^4 + 3z^3- 15z^2 + 18z- 12]
(b): G (z) = [4 z^4- 9z^3+15 z^2-7]/[z^4-2 z^3+10 z^2+6z+64]

Experiment 13: Develop an efficient program to scan the elements of 8*8 matrixes Given below In zig –zag order (i.e. from 0 to 63 in order)

0	1	5	6	14	15	27	28
2	4	7	13	16	26	29	42
3	8	12	17	25	30	41	43
9	11	18	24	31	40	44	53
10	19	23	32	39	45	52	54
20	22	33	38	46	51	55	60
21	34	37	47	50	56	59	61
35	36	48	49	57	58	62	63

Experiment 14: Generate and plot the complex exponential sequence

1.5 exp [(0.3 + jπ/3)n] ; for n≤50

LIST OF EXPERIMENTS ON TMS320C6713 DSK DSP KIT

Experiment 1: DESIGN & CONDUCT IIR HIGH PASS FILTER
Experiment 2: DESIGN & CONDUCT IIR LOW PASS FILTER
Experiment 3: DESIGN & CONDUCT FIR LOW PASS FILTER
Experiment 4: DESIGN & CONDUCT FIR HIGH PASS FILTER
Experiment 5: GENERATION OF WAVE FORM

a) Square Waveform
b) Saw tooth Waveform
c) Sinusoidal Waveform

MICROWAVE ENGINEERING (LAB) (EC-1652)

Experiment 1: To Study the Characteristics of Reflex Klystron and to determine its electronic tuning range.
Experiment 2: To determine the frequency and wavelength in a rectangular waveguide working in TE_{10} mode.
Experiment 3: To Measure the Standing Wave Ratio (SWR) and Reflection Coefficient.
(a) Low VSWR (b) High VSWR
Experiment 4: To measure an unknown impedance with smith chart.
Experiment 5: To study V-I characteristics of GUNN diode.
Experiment 6: Study the function of directional coupler by measuring the following parameters
Experiment 7: To measure main line and main line VSWR
Experiment 8: To measure the coupling factor and directivity.
Experiment 9: Study of Magic Tee.
Experiment 10: To measure the polar pattern and gain of a Horn antenna.
Experiment 11: Simulation of basic microwave components.
Experiment 12: Design of RF amplifier

MICROELECTRONICS AND VLSI DESIGN (LAB) (EC-1653)

Experiment 1: To write a hardware description of 4-bit adder and subtractor and test its operation

Experiment 2: To write a hardware description of Degree to radian converter

Experiment 3: To write a hardware description of 4-bit mod 13 counter and test its operation

Experiment 4: To write a hardware description of 8-bit register with shift left and shift right operation and test its iopeation

Experiment 5: To write a hardware description of 4-bit array Multiplier

Experiment 6: To write a hardware description of Booth Multiplier

Experiment 7: To Design NOT, NOR, NAND gates using MENTOR GRAPHICS and compute the delay between input and output waveforms

Experiment 8: To Design 2:1 MUX using MENTOR GRAPHICS and compute the delay between input and output waveforms

Experiment 9: To Design XOR, NOR, NAND gates using MENTOR GRAPHICS and compute the delay between input and output waveforms and compare the difference between CMOS and pseudo technique.

Experiment 10: To Design XOR gate using CMOS and pseudo NMOS technique using MENTOR GRAPHICS and compute the delay between input and output waveforms and compare them

Experiment 11: To Design and simulate D-FLIP FLOP as a MASTER-SLAVE configuration using MENTOR GRAPHICS

Experiment 12: To Design Ring Oscillator using MENTOR GRAPHICS and compute the delay between input and output waveforms.

Experiment 13: To Design 2:1 MUX using transmission gates using MENTOR GRAPHICS

Experiment 14: To Design 6-T SRAM using MENTOR GRAPHICS and compute the delay between input and output waveforms

MOBILE AND WIRELESS COMMUNICATION (EC-1701)

UNIT 1: Introduction to mobile communication systems, Comparison of wireless systems and trends. 2(L)

UNIT 2: Cellular concept and system design fundamentals, channel assignment strategies, Hand-off strategies. Interference and system capacity. Improving capacity in cellular systems. 4(L)

UNIT 3: Mobile radio propagation, Ground reflection model, diffraction sculpturing, Indoor propagation models, outdoor propagation models, ray tracing and site specific signalling 6(L)

UNIT 4: Modulation techniques for mobile radio, diversity , Multipath fading using Rayliegh and Rician PDF, Flat fading and frequency selective fading, fading effects due to Doppler spread, speech coding, channel coding, 7(L)

UNIT 5: RAKE Receiver multiple access techniques for mobile communication, capacity ofcellularsystems 3(L)

UNIT 6: Multiple access techniques, FDMA, TDMA, CDMA 4(L)

UNIT 7: Wireless systems and standards.GSM, IS-95, 3G (IMT-2000,UMTS, 4G (WIMAX) 4(L)

UNIT 8: Introduction to wireless networking Development of wireless network, wireless data services, Mobile Satellite communication, Common channel signalling. 5(L)

UNIT 9: Protocols for network access network databases 2(L)

Text/Reference Books:

- Wirless Communication - Principle and practice – T.S. Rappaport
- Mobile Communication – Schwartz
- Wireless Communications and Networks- William Stallings.
- Desigining CDMA 2000 Systems – Leonard Korowajczuk, Bruno DEsouza, Abren Xavier and Arlindo Morieira Fartes
- CDMA Access and Switching for Terrestrial and Satellite Networks- Diakoumis, Gerakoulis, Evaggelos.

PROFESSIONAL ELECTIVE-I

ADVANCED COMPUTER ARCHITECTURE (EC1731)

UNIT 1: Introduction to parallel processing-Necessity of high performance, Constraints of conventional architecture, Parallelism in uni processor system, Evolution of parallel processors, Future trends, Architectural classification, Applications of parallel processing, Programming and networking properties, Principles of scalable performance, Conditions of parallelism, Data and resource dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Program flow mechanisms, Control flow versus data flow, Data flow architecture. 8(L)

UNIT 2: Pipelining-Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Arithmetic Pipeline Design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipelines. 8(L)

UNIT 3: Processors Technology-Advanced processor technology, Instruction-set Architectures,CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors,VLIW Architectures, Vector Processing Principles, Vector instruction types, Vector-access memory schemes, CRY-1 architecture. 8(L)

UNIT 4: Memory Technology-Hierarchical memory technology, Inclusion, Coherence and Locality, Memory capacity planning, Virtual Memory Technology. 5(L)

UNIT 5: System Interconnect Architectures: Network properties and routing, Static interconnection networks, Dynamic interconnection Networks, Multiprocessor system interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network. 5(L)

UNIT 6: Synchronous Parallel Processing : SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, SIMD Computers and Performance Enhancement, SIMD matrix multiplication, Parallel sort, FFT. 6(L)

Text/Reference Books:

- Kai Hwang, "Advanced computer architecture"; TMH.
- Hwan and Briggs, " Computer Architecture and Parallel Processing"; MGH.
- Hennessy and Patterson , "Computer Architecture: A Quantitative Approach", 3rd edition, Morgan Kauffmann
- Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication.
- V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI.
- R.K.Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing"; Narosa Publications. Kai Hwang and Zu, "Scalable Parallel Computers Architecture"; MGH.
- D.Sima, T.Fountain, P.Kasuk, "Advanced Computer Architecture-A Design space Approach,"Addison Wesley,1997.
- M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing

EMBEDDED SYSTEMS (EC-1732)

UNIT 1: Introduction to Embedded systems- Introduction, Categorization of Embedded Systems, Exemplary Systems, Selection of Processor and Memory for Embedded Systems, DMA, I/O Devices, Interrupt Service Handling for Embedded Systems, Embedded Tools in C/C++, Memory Optimization. 6(L)

UNIT 2: 8-bit Microcontrollers- Introduction to MCS-51 Family, Architectural Features, Organization of Data & Program Memories, Orthogonal Architectural Features, Addressing modes, Instruction Set, Programming, 8051 Interrupts, Writing ISRs, SFRs, Programming on-chip Devices, UART and Serial Port Programming, Power Saving Modes. 10(L)

UNIT 3: Interfacing & Applications- External Memory Interfacing, Interfacing ADC, Display Systems (7-Seg & LCDs)**,** Potentiometer Position Measurements, Temperature Monitoring/Control for ACs, Light Sensors for Robotics, Ultrasonic Distance Measurements, PWM Motor Control, RS-232 Interface, Servo Positioner System. 10(L)

UNIT 4: Enhanced MCS-51 Features- Architectural Enhancements in Scratchpad RAM, Watchdog Timers, Onboard PWM, HSM Controllers, High Speed Serial Port, Introduction to MCS—151/251. 6(L)

UNIT 5: Real Time Operating System- Introduction to OS Concept, System Services, RTOS basics, Task Scheduling, Interrupt latency, Example RTOS for MCS-51: RTOSLITE & FULLRTOS. 8(L)

Text/Reference Books:

- Raj Kamal, Embedded System Architecture, Programming and Design, 2nd Ed, Tata McGraw Hill.
- Myke Predko, Programming and Customizing the 8051 Microcontroller, Tab Books/ Tata McGraw Hill.
- M.A. Mazidi, J.G. Mazidi, R.D. McKinlay, The 8051 Microcontrollers and Embedded Systems: Using Assembly and C, 2nd Ed, Pearson Education.
- John Catsoulis**,** Designing Embedded Hardware, O'Reilly Media, Inc.
- K. J. Ayala, The 8051 Microcontrollers Architecture Programming & Applications, 2nd Ed, Penram International.
- L. B. Das, Embedded Systems: An Integrated Approach, Pearson Education.

MICRO-COMPUTER BASED SYSTEM DESIGN (EC-1733)

UNIT 1: Review of 8086 & Programming through PC- BIU & EU, Addressing Modes & Programming and CPU Module Design: Bus Buffering and Latching, Fully Buffered Systems, Bus Timings, Read & Wait etc.
Use of Memory Models, Realization of Array Structures, Display Screen & Keyboard Processing with INT and BIOS Functions Calls, .COM and .EXE Programs, Use of Macros, LOCAL, EXTRN and PUBLIC. 8(L)

UNIT 2: Interfacing with 8086

(a) Memory Interfacing- Physical Memory Organization, Memory Interfacing, Parity Error Detection & Correction, DRAM Interfacing. 4(L)

(b) Special Interfacing Devices- Interrupt Response of 8086, Interfacing 8259 Priority Interrupt controller, Interrupt modes, Master/Slave Configuration, DMA Response of 8086, Interfacing 8237 DMA Controller and DMA Modes, The 8279 Controller, Keyboard Formats & Display Modes, Interfacing Keypad and Alphanumeric Displays for SDK-86 System. 8(L)

UNIT 3 Serial Communication

(a) Introduction & USART Interfacing- Formats and Protocols, Interfacing 8251 USART Operating Modes, Modem Control, Serial Transfer between two 8086 single board microcomputers. 4(L)

(b) Using PCs Serial Port- Architecture & Configuration of Port, IRQ Conflicts, Linking Two Devices with RS-232, Linking RS-232 Applications such as 2-PC Link, PC-to-Basic Stamp Link, PC-to 8052-Basic Link. 4(L)

UNIT 4 Measurement/Instrumentation- Interfacing A/D Converters, Analog Multiplexers, Sample and Hold, D/A Converters, Measurement of Frequency, Measuring KWH, Power Factor, Measurement & Display of Motor Speed, Microcomputer based smart scale etc. 6(L)

UNIT 5 Industrial Process Control- Overview, Liquid Level Monitoring & Control, Microprocessor based Protective Relays, Temperature Control in Vacuum Furnaces, Servo Motor Control etc. 6(L)

Text/Reference Books:

- D.V. Hall, Microprocessors and Interfacing, 2nd Ed, TMH.
- Liu & Gibson, Microcomputer Systems: The 8086/8088 Family Architecture, Programming and Design, 2nd Ed, PHI.
- Barry B Brey, The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, Pentium, and Pentium Pro Processors, PHI
- Jan Axelson, Serial Port Complete Programming & Circuits for RS-232 and RS-485 Links and Networks, Penram International.
- Peter Abel, IBM PC Assembly Language and Programming, 3rd Ed, PHI.
- The Intel Handbook of peripheral devices.

MEMS AND INTEGRATED SENSORS (EC-1734)

UNIT 1: Introduction to MEMS; MEMS technologies; Applications; 6(L)
UNIT 2: Micromachining- surface and bulk; MEMS processes; 6(L)
UNIT 3: Principle of sensors; Smart sensors, temperature sensors, pressure and strain gauges, optical sensors, PH sensors, On-chip integration of sensors; 10(L)
UNIT 4: Micropower OP AMPS; BIMOS chips for analog and digital functions; 6(L)
UNIT 5: Micromachined actuators; flow sensors, accelerometers, gyro; 6(L)
UNIT 6: Biomedical and process control chips with integrated sensors. 6(L)

PROFESSIONAL ELECTIVE-II

RADAR & SATELLITE COMMUNICATION (EC-1741)

Radar

UNIT 1 Introduction: Principle of detection and ranging, Radar frequencies and bands. Applications, Radar block diagram and operation. Radar Range Equation: Range prediction, Minimum detectable signal, Receiver noise SNR, Integration of radar pulses, 5(L)

UNIT 2 Radar cross section of targets, Transmitter Power, PRF and system losses & Propagation effects. 3(L)

UNIT 3 CW FM Radar: Doppler effect, CW Radar, Frequency-modulated CW Radar, Multiple-frequency CW Radar. MTI and Pulse Doppler Radar: MTI delay lines, Delay line Cancellers, Coherent and Non-Coherent MTI, Pulse Doppler Radar 8(L)

UNIT 4 Tracking radar, Earth penetrating radar, Radar clutter, Radar antenna 4(L)

Satellite

UNIT 5 Introduction: Communication satellites, Orbiting satellites, Orbital mechanics Frequencies and bands, Satellite Transponder: Transponder model, Satellite signal processing RF-RF translation, IF demodulation. 5(L)

UNIT 6 Satellite link analysis for uplinks and downlinks, Satellite Channel: Power flow, Polarization, Atmospheric losses, Earth station technology, Receiver noise, CNR. 5(L)

UNIT 7: Modulation and multiplexing techniques for satellite links, Multiple-Access: FDMA, TDMA, Synchronization, SS-TDMA; CDMA; DS CDMA, Frequency- hopped, CDMA. Carrier recovery & bit timing 5(L)

UNIT 8: Global positioning system, DTH, V-SAT, mobile satellite communication. 5(L)

Text/Reference Books:

- Introduction to Radar Systems - M.I. Skolnik
- Satellite Communication - T. Pratt & C.W. Boston
- Radar Fundamentals - G.J. Wheeler.
- Radar – principles, technology, applications – Byron Edde
- Digital satellite communication- T. Ha
- Satellite Communication - R.M. Gagliardi
- Satellite Communication System Design Principles - M. Richharia

ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY (EC-1742)

UNIT 1: EMI ENVIRONMENT-Sources of EMI, conducted and radiated EMI, Transient EMI, EMI-EMC Definitions and units of parameters. 6(L)

UNIT 2: EMI COUPLING PRINCIPLES-Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply Coupling. 8(L)

UNIT 3: EMI SPECIFICATIONS/STANDARDS/ LIMITS-Units of specifications, Civilian standards Military standards. 6(L)

UNIT 4: EMI MEASUREMENTS-EMI Test Instruments /Systems, EMI Test, EMI Shielded Chamber, Open Area Test Site, TEM Cell Antennas, Conductors Sensors/Injectors/Couplers, Military Test Method and Procedures, Calibration Procedures. 6(L)

UNIT 5: EMI CONTROL TECHNIQUES-Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting. 6(L)

UNIT 6: EMC DESIGN OF PCBS-PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models. 8(L)

Text/Reference Books:

- Bernhard Keiser, "Principles of Electromagnetic Compatibility ", Artech house, 3rd Ed, 1986.
- Henry W.Ott, "Noise Reduction Techniques in Electronic Systems ", John Wiley and Sons, 1988.
- V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies ", IEEE Press, 1996.
- Learning Materials on Electromagnetic Interference and Compatibility, prepared by IIT, New Delhi, for the project IMPACT, DoE, Government of India, 1997.

DIGITAL TRANSMISSION (EC-1743)

UNIT 1: Elements of Communication systems, communication Channels and their characteristics, Mathematical model for communication Channels, Characterization of communication signals and systems, Representation of bandpass signals and systems, signal space representation, spectral characterization of digitally modulated signals 10(L)

UNIT 2: Optimum receivers for the additive white Gaussian noise channels, performance of the optimum receivers for memoryless modulation, carrier and symbol synchronization, signal design of bandlimited channels, adaptive linear equalizer 10(L)

UNIT 3: Digital transmission through fading multipath channels, characterization of fading multipath channels, performance of fading multipath channels, Digital signaling over a frequency selective slowly fading channel, 10(L)

UNIT 4: Diversity techniques for fading multipath channels, Introduction to multiuser communication systems and their applications, Simulation of Communication Systems. 10(L)

Text/Reference Books:

- John J. Proakis, "Digital communication" Fourth Ed. MGH
- D. R. Smith, "Digital Telecommuniocation", Springer
- B. Sklar, "Digital communication: Fundamentals and applications" Prentice Hall

VLSI FOR TELECOMMUNICATIONS AND SIGNAL PROCESSING (EC-1744)

UNIT 1: Review of communication concepts from circuit designer perspective. General VLSI optimization techniques, partitioning and synthesis of different telecommunication blocks. Telecommunication system integration in single chip/ multichip module, high throughput and low delay/latency design requirement for real time communication, critical path analysis for high speed VLSI design, switched capacitor circuits, high speed A/D and D/A converters. Receiver architectures for different systems. Active and passive mixers. Frequency synthesizer circuits.

VLSI CAD tools, softwares and languages, low power ciruits/architecture design methodologies, high speed switching circuits, high speed memory organization, high speed control & decision circuits, design of analog front ends, impedance matching with bonding pads, Si-Ge devices for RF circuits, interface for optical fibres, VLSI for generation and detection of PSK, FSK, QAM etc,, subscriber line interface circuits, network switching circuits, VLSI systems for modem design, adaptive filters, equalizers, CVSD codecs, PLL, ISDN, UDLT, USART, Viterbi decoding, data encryption, DSPs, audio/video compression, video conferencing, Case studies for implementation of specific protocols currently in vogue.

UNIT 2: VLSI implementation and design issues related to Discrete Fourier transform, digital filter design techniques; computation of discrete Fourier transform; discrete Hilbert transform; discrete random signals; effect of finite register length in digital signal processing; power spectrum estimation. Design issues related to VLSI for signal processing.

Text/Reference Books:

- VLSI for Wireless Communication: Pearson Education, Low Price Edition, Bosco Leung, Charles G. Sodini.

LAB ELECTIVES:

ADVANCE WIRELESS AND OPTICAL COMMUNICATION (LAB) (EC-1751)

Experiment 1: Introduction to Lab VIEW software and the RF Hardware
Experiment 2: Baseband QAM modulation.
Experiment 3: Baseband QAM Demodulation.
Experiment 4: Channel Estimation and synchronization.
Experiment 5: Frequency Offset Estimation and Correction.
Experiment 6: OFDM Modulator and Demodulator.
Experiment 7: OFDM Synchronization, Frequency Offset, and Channel Estimation.
Experiment 8: Wireless sensor networks based on motes to form a base station and its neighbor to realize physical parameters like temperature, humidity.
Experiment 9: Study of fiber optic Transmitters and Detectors
Experiment 10: Study Of Simplex and Duplex Fiber Optic Link
Experiment 11: Study Of digital Transceiver
Experiment 12: Determination of numerical aperture of optical fibers
Experiment 13: Transmission of an audio signal through an optical fiber
Experiment 14: Fiber optic characterization: attenuation, chromatic dispersion, polarization dispersion (PMD).
Experiment 15: Verification of installations and fiber links with OTDR (optical time domain Reflectometer)

ADVANCED MICROPROCESSORS (LAB) (EC-1752)

Programming Experiments on TASM/MASM Assembler:

Experiment 1: Write a program to add the two data tables stored in memory. Assume 8-bit data and store the result in another table present in Data Segment.
Experiment 2: Write a program to ADD/ SUBTRACT two BCD numbers, stored in Data Segment, via BCD instructions.
Experiment 3: Write a program to Sort a data array in ascending and descending order.
Experiment 4: Write a program to read the keyboard entries and display on the screen by using INT Function Calls.
Experiment 5: Write a user interactive program to find factorial of an 8-bit integer, recursively.
Experiment 6: Write a user interactive program to multiply two 3 X 3 matrices stored in Data Segments.

Experiments on SDK-86:

Experiment 1: Familiarization with SDK-86
a. Storing and Executing programs in SDK-86 trainer kit: Register Addition, Indirect Subtraction and Immediate Add with Carry.
b. Obtaining PSW Status at the end of execution.
Experiment 2: Write a program to verify the INT instructions for (i) Overflow and (ii) Divide by Zero error.
Experiment 3: Write a program to ADD a series of 16-bit numbers stored in memory via LEA.
Experiment 4: Write a program to find out square of an integer from a look table via XLAT.
Experiment 5: Write a program to transfer a table from one memory location to another location in Extra Segment by using string instructions of 8086.
Experiment 6: Write a program to search a character in a given table, stored in Extra Segment by using string instructions of 8086.
Experiment 7: Interface 8 serial switches and 8 LEDs to 8086 through 8255 and write a program t0 display the status of switches on LEDs continuously.
Experiment 8: Write a program to transfer 10 bytes from one SDK-86 kit to another by using MODE-1 operation of 8255.
Experiment 9: Interface an 8259 Priority Interrupt Controller to 8086 and write a program to verify the Fully Nested Mode and AEOI mode of operation of 8259.
Experiment 10: Interface two 8259 Priority Interrupt Controllers to 8259 and write a program to verify the master/slave operation of 8259.
Experiment 11: Write a program to display '8086' on the 7-segment display digits by using the 8279 programmable keyboard/display controller IC.

Experiment 12: Write a program for the moving display '8086' on the 7-segment display digits by using the 8279 programmable keyboard/display controller IC.
Experiment 13: Interface an 8251 to 8086 and write a program to verify the asynchronous mode of operation of 8251.
Experiment 14: Interface an 8251 to 8086 and write a program to verify the synchronous mode of operation of 8251.
Experiment 15: Interface an 8257 to 8086 and write a program to transfer a data block from one memory location to another by using the DMA.
Experiment 16: Interface an Analog to Digital converter and write a program to verify the operation of ADC.
Experiment 17: Interface a Digital to Analog converter and write a program to verify the operation of DAC.
Experiment 18: Study & Verification of (i) DC Motor Control (ii) Stepper Motor Control.
Experiment 19: Measurement of frequency of an unknown sinusoid.
Experiment 20: Measurement of a electrical quantity such as voltage and current.
Experiment 21: Measurement of a physical quantity such as temperature, pressure etc.

ADVANCED VLSI (LAB) (EC-1753)

Experiment 1: To Design NOT, NOR, NAND gates using HSPICE & CADENCE and compute the delay between input and output waveforms
Experiment 2: To Design 2:1 MUX using HSPICE & CADENCE and compute the delay between input and output waveforms
Experiment 3: To Design XOR, NOR, NAND gates using HSPICE & CADENCE and compute the delay between input and output waveforms and compare the difference between CMOS and pseudo technique.
Experiment 4: To Design XOR gate using CMOS and pseudo NMOS technique using HSPICE & CADENCE and compute the delay between input and output waveforms and compare them
Experiment 5: To Design and simulate D-FLIP FLOP as a MASTER-SLAVE configuration using HSPICE & CADENCE
Experiment 6: To Design Ring Oscillator using HSPICE & CADENCE and compute the delay between input and output waveforms.
Experiment 7: To Design 2:1 MUX using transmission gates using HSPICE & CADENCE
Experiment 8: To Design 6-T SRAM using HSPICE & CADENCE and compute the delay between input and output waveforms
Experiment 9: To Design and simulate CS-Amplifier and calculate transconductance using CADENCE
Experiment 10: To Design and simulate Current-Mirror circuit and calculate transconductance using CADENCE
Experiment 11: To Design and simulate Differential-Amplifier circuit and calculate transconductance using CADENCE
Experiment 12: To Design and simulate INVERTER Circuit and calculate delay, power for various values of W/L using CADENCE
Experiment 13: To Design and simulate INVERTER Circuit and perform transient, DC, Parametric, Noise and PSS analysis using CADENCE
Experiment 14: To Design and simulate INVERTER, NAND, NOR Circuits and calculate noise margin using HSPICE & CADENCE
Experiment 15: Design and simulate INVERTER, NAND, XOR Circuits and calculate delay, power for pre-layout and post-layout using CADENCE

FPGA (LAB) (EC-1754)
Experiment (Any 10)
All experiments to be dumped to FPGA and tested.

Experiment 1: Design and Simulation of 4-bit parallel Adder
Experiment 2: Design and Simulation of 4 X 1 MUX
Experiment 3: Design and Simulation of D Flip-Flop
Experiment 4: Design and Simulation of JK Flip-Flop
Experiment 5: Design and Simulation of T Flip-Flop
Experiment 6: Design and Simulation CLOCK GENERATOR
Experiment 7: Design and Simulation of UP-DOWN Counter
Experiment 8: Design and Simulation of BCD to Excess-3 code
Experiment 9: Design and Simulation of 3 to 8 Decoder
Experiment 10: Design and Simulation of 4to 16 Decoder
Experiment 11: Design and Simulation of 4 bit ripple counter
Experiment 12: Design and Simulation of 4 bit Adder and Subtractor
Experiment 13: Design and Simulation of 4 bit mod 13 counter
Experiment 14: Design and Simulation of 8 bit register

PROJECT (EC-1791)

ADVANCED DIGITAL SIGNAL AND IMAGE PROCESSING (EC-1801)

UNIT 1: Statistical Signal Processing: Method of least squares (LS). Recursive LS. Parameter estimation. Nonparametric Estimation: Correlation and spectral analysis. Cepstrum. Yule-Walker equation. Singular Value Decomposition (SVD) and Introduction to Adaptive Signal Processing 7(L)

UNIT 2: Multirate DSP: up-sampler and down-sampler, filters in sampling rate alternation systems; multi-stage design of decimator and interpolator, polyphase decomposition; arbitrary sampling rate converter, Lagrange interpolation, digital filter banks, uniform DFT filter banks, Nyquist filters, quadrature-mirror filter banks, perfect reconstruction two-channel FIR filter banks, multi-level filter banks. 7(L)

UNIT 3: 2D systems and mathematical preliminaries, Linear operations on images. Digital Representation of Binary & Gray Scale and colour Images 4(L)

UNIT 4: Fundamental steps in image processing. Elements of Digital Image Processing Systems, Some basic relationship between pixels 2(L)

UNIT 5: Image sampling and quantization: 2D Sampling on rectangular and nonrectangular sampling lattice, Aliasing, Image Quantization, Visual Quantization 2(L)

UNIT 6: Image transforms: 2D Orthogonal and Unitary Transforms Basis image, Properties of Unitary Transforms, 1D and 2D Discrete Fourier transform and its properties DCT, DST and its properties, Walsh, Hadamard Transform, Harr & Slant transform, and KLT 5(L)

UNIT 7: Fundamentals of Wavelet transform and it application, Image analysis using multi-resolution techniques. 2(L)

UNIT 8: Image Enhancement Techniques: Spatial domain and frequency domain Methods, Gray scale transformation, Histogram matching and equalization, Smoothening:- Noise Removal, Averaging, Median, Min/Max. Filtering sharpening of Images is using differentiation, the Laplaciam, High Emphasis filtering, Edge detection 4(L)

UNIT 9: Image restoration: Degradation model, averaging, inverse and Wiener filtering 4(L)

UNIT 10: Image Data Compression, Image redundancies, Lossy and Lossless Compression, Pixel coding, Predictive coding, Fidelity criteria. DCT and wavelet based Transform Coding schemes, Huffman, Run-length and Arithmetic coding, JPEG and JPEG2000 5(L)

UNIT 11: Image Segmentation: Line and Edge Detection, Detection of discontinuities, edge labelling and boundary detection, Edge linking, Hough Transform, Thresholding histogram Technique. Image segmentation using similarities: region growing, Split and Merge 3(L)

Text/Reference Books:

- Digital Signal Processing: A Computer Based Approach, 3e, McGraw Hill- Sanjit K. Mitra,
- Fundamentals of Statistical Signal Processing- S. M. Kay,
- Digital Image Processing –R. C. Gonzalez & Richard E. Woods
- Fundamentals of Digital Image Processing – A. K. Jain
- Digital Signal Processing: Principles, Algorithms, and Applications by J. G. Proakis and D. G. Manolakis.
- Digital Image Processing – C. Rafel & Paul Wintz
- Digital Picture Processing – A. Rosenfield & A.C. Kak
- Orthogonal Transform for Digital Signal Processing – N. Ahmad & K.R. Rao
- Discrete-Time Signal Processing - Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck,
- Digital Video Processing, Prentice-Hall, 1995 - A.M.Tekalp,.
- Handbook of Image and Video Processing, Academic Press, 2000. - A.Bovik,
- Wavelets and Subband Coding, Prentice-Hall, 1995- M.Vetterli and J.Kovacevic,
- Multirate Systems and Filterbanks, Prentice Hall, 1993 - P.P. Vaidyanathan,.
- Statistical Signal Processing and Modeling- M. Hayes

PROFESSIONAL ELECTIVE-III

DIGITAL HARDWARE DESIGN (EC-1831)

UNIT 1: Revision of Combinational and sequential logic- Review of POS and SOP minimization, Multi output function, Variable entered mapping, Computer Arithmetic, ASM, FSM, Shift register, Timing and triggering, Clock skew, Device technologies, System representation, Levels of Abstraction, Development tasks and EDA software, Development flow**.** 8(L)

UNIT 2: Hardware Description Languages-Digital Hardware Elements and Their Description in Hardware Description Language, System Structuring Methodology, (VHDL/Verilog), Simulation and its different types.8(L)

UNIT 3: Circuit Design- Combinational Circuit Design, Sequential Circuit Design, Finite State Machine, Register Transfer Methodology, Hierarchical design, Clock and Synchronization. 8(L)

UNIT 4: Microprocessor design- Data Path design, Control unit design, Hardware, Software and Firmware Considerations in Designing Control units, Arithmetic and Logic unit of Processors, Example of dedicated processor (GCD), General purpose processor design. 8(L)

UNIT 5: FPGA Based design- Programmed Logic Devices, Fundamental concept of FPGA, Architecture of FPGA, FPGA programming, Schematic and HDL based design flow, Serial Communication, Memory, Digital filters, DSP based design, IP. 8(L)

Text/Reference Books:

- An Engineering approach to Digital Design - W.I. Flecher
- Switching and finite automata theory- Zvi Kohavi
- Digital logic and microprocessor design with VHDL- Hwang
- Digital System design using VHDL- C H Roth
- RTL Hardware design using VHDL- PP Chu
- VHDL programming by example- perry , perry

SWITCHING CIRCUITS AND FINITE AUTOMATA THEORY (EC-1832)

UNIT 1: Structural properties of switching functions- Functional decomposition, Symmetric networks, Identification of symmetric functions, Threshold Logic**,** analysis and synthesis of threshold networks. 6(L)

UNIT 2: Reliable Design and Fault Diagnosis in combinational circuits- Hazards, Fault models, Fault detection and location in combinational circuits, Fault detection by fault-table, path sensitizing, and Boolean difference methods, D-algorithm, Delay fault testing, Detection of multiple faults, Failure-tolerant design, Quadded logic. 7(L)

UNIT 3: Synchronous sequential circuits- Finite-state model, Capabilities and limitations of finite-state machines, State equivalence and machine minimization, Analysis and synthesis of synchronous sequential circuits, Simplification of incompletely specified machines. 7(L)

UNIT 4: Asynchronous Sequential Circuits- Fundamental-mode circuits, Analysis and synthesis of asynchronous sequential circuits, State assignment in asynchronous sequential circuits, Hazard-free asynchronous circuits. 7(L)

UNIT 5: Fault-Detection and Location in Sequential Circuits- Homing experiments, Distinguishing experiments, Machine identification, Fault-detection experiments, Design for testability, Scan design, Built-in Self-Test (BIST). 6(L)

UNIT 6: Memory, Definiteness, and Information Losslessness of Finite Automata- Properties of finite-memory machines, Definite machines, Tests for definiteness, Finite output memory machines, Information lossless machines, Inverse machines. 7(L)

Text/Reference Books:

- Z. Kohavi and N. K. Jha, Switching and Finite Automata Theory, Tata McGraw-Hill, Third Edition
- M. Abramovici, M. A. Breuer, and A. D. Friedman, Digital Systems Testing and Testable Design, Wiley-IEEE press, 1994. IL.
- R. D. Adams, High Performance Memory Testing, Kluwer Academic Publishers, 2002.
- J. Altet and A. Rubio, Thermal Testing of Integrated Circuits, Kluwer Academic Publishers, 2002.

LOW POWER VLSI DESIGN (EC-1833)

UNIT 1: Introduction- IC Power consumption concerns. Limits of Power in Microelectronics. Low-power design methodologies. 3(L)

UNIT 2: Power Consumption in CMOS Digital Designs- Switching component of power. Switching energy per transition. Conventional CMOS circuits with rail-to-rail swing. Charge sharing. Components of node capacitance. Definition of transition activity factor. Influence of logic level statistic and circuit topologies on the node transition activity factor. Word level signal statistics influencing activity. Influence of voltage scaling. Short-circuit component of power. Leakage component of power. Diode Leakage. Sub-threshold leakage. Static Power. Reduced voltage levels feeding CMOS gates. Pseudo-NMOS logic style. 12(L)

UNIT 3: Voltage Scaling Approaches- Reliability-driven voltage scaling. Technology-driven voltage scaling. Energy x delay minimum based voltage scaling. Voltage scaling through optimal transistor sizing. Voltage scaling using threshold reduction. Architecture-driven voltage scaling. Trading area for lower power through hardware duplication. Optimal supply voltage for architecture driven voltage scaling. Trading area for lower power through hardware pipelining.. Noise Considerations at reduced supply voltage. Digital design with multiple supplies. 9(L)

UNIT 4: Adiabatic Switching- Adiabatic charging. Adiabatic amplification. One-stage adiabatic buffer in conventional system. Two-stage adiabatic buffer in conventional system. Fully-adiabatic system. Comparison with conventional buffer. Supply voltage influence. Adiabatic logic gates. Fully-adiabatic sequential circuits. Partially-adiabatic sequential circuits. Stepwise charging. Pulsed-power supplies. Optimization algorithms. 8(L)

UNIT 5: Leakage Power Reduction- Leakage current in deep submicron ICs. Gate oxide tunneling. Supply power control. Bulk-source biasing. Bias voltage generator. Logic gate optimization for leakage power. Input vector selection for standby mode. 5(L)

Text/Reference Books:

- Low Power CMOS VLSI circuit design By Kaushik Roy and S.C Prasad, Publisher : John Wiley & Sons.
- CMOS/BiCMOS VLSI : Low Voltage Low Power By K.S.Yeo, S.S.Rofail,W.L.Goh Publisher : Prentice Hall.
- Low Power Digital CMOS Design By A.P.Chandraksen, R.W.Brodersen Publisher : Kluwer Academics

ADVANCED DSP ARCHITECTURE (EC-1834)

UNIT 1: Introduction in concepts and architectures used in digital signal processing 2(L)

UNIT 2: Parallel architectures specialized in digital signal processing 2(L)

UNIT 3: Digital signal processors, Processing architectures : von Neuman (SISD), Harvard, SIMD, MIMD. Comparison: CISC-RISC vs.Transputers. DSP types:fixed point , floating point. TI DSP family. 4(L)

UNIT 4: Fixed point DSP fundamentals (structure of TMS320C25 family), Internal architecture. External connections. Memory organization. Peripherals. Interrupts. 5(L)

UNIT 5: Instruction set of TMS320C2x family, Addressing modes- direct, immediate, indirect, bit-reverse. Instructions. COFF format . Q15 representation. 4(L)

UNIT 6: Other DSP structures (enhanced fixed point-TMS320C5x, C54x , floating point- 3x,4x families, high performance 8x, 6x), Internal architecture- improvements compared with C2x. Hardware implementation of loops. Memory organization. Interrupts.. Addressing modes. Instruction set. MVP TMS320C80 - internal architecture. TMS320C54x. Architecture. Improvements. TMS320C6x . VLIW Architecture -VelociTI. C6201 chip. 6(L)

UNIT 7: Mathematical fundamentals of filter and FFT design- Digital filters. FIR filters. IIR filters, FFT-proprieties. Base algorithm. Fast algorithms. 4(L)

UNIT 8: Interconnection in DSP systems (high performance buses) 2(L)

UNIT 9: Testing DSP based systems (Jtag interfaces) 2(L)

UNIT 10: Practical applications using DSP 3(L)

Text/Reference Books:

- Chassaing, Rulph, Digital Signal Processing: Laboratory Experiments Using C and the TMS320C31 DSK. John Wiley & Sons, Inc., New York, 1999.
- Dake Liu, Design of embedded DSP processors, compendium
- Phil Lapsley, Jeff Bier, Amit Shoham "DSP Processor Fundamentals, Arhitectures and Features", IEEE Press.
- Michael J. Flynn "Computer Architecture. Pipelined and parallel processor design", Jones and Bartlett, 1995.
- Kehtarnavaz, Nasser; Simsek, Burc, C6x-Based Digital Signal Processing. Prentice Hall, New Jersey, 2000.
- Gomaa, Hassan, Software Design Methods for Concurrent and Real-Time Systems. Addison-Wesley Publishing Company, Inc., 1993.

PROFESSIONAL ELECTIVE-IV

INFORMATION THEORY AND CODING (EC-1841)

UNIT 1: Information and its measure, Entropy, Eisenstein's axiomatic approach, Source Entropy and its extensions, uncertainly. 6(L)

UNIT 2: Source coding theories, Data compaction Huffman coding, Huffman Tree, Lemopel - ziv coding 6(L)

UNIT 3: Discrete Memory less Channels, binary symmetric channel, mutual information, channel capacity, channel coding theorem. Information capacity Theorem, sphere packing. 6(L)

UNIT 4: Cascaded and special channels, markov processes & their entropy, information capacity of coloured Noise Channel. 5(L)

UNIT 5: Rate distortion Theory, Data compression calculation of syndrome. 4(L)

UNIT 6: Error control coding, Error detection and correction, Linear block codes, cyclic codes, Generator polynominal, Haming codes, BCH codes, convolutional codes, Parallel concatenated convolution code (PCCC), Senal concatenated convolution codes (SCCC) & their applications. 9(L)

UNIT 7: Maximum likelihood Decoding of convolution codes, Veterbi Algorithm, Asymptotic coding gain. 4(L)

Text/Reference Books

- Gareth & Jones, Jodephine Man "Information & Coding Theory"
- J.H. Ewing, Itatmos Branka "Coding and Information Theory".
- Veucetic, Jinhong Yhan "Turbo coding"
- John. J Proakis "Communication System"
- Simon Haykin "Communication System".

WDM OPTICAL NETWORKS (EC-1842)

UNIT 1: Introduction to Optical Networks- Principles and Challenges and its Generation, Optical Transmission systems,Wavelength Division Multiplexing,Wavelength Add/Drop Multiplexer, OpticalFilters, Optical Amplifiers, Wavelength cross connect, Evolution of WDM Optical Network,WDM Point-to-point Link. 8(L)

UNIT 2: Enabling technologies for WDM optical networks, WDM optical networks architecture, Broadcast-and-select network, Wavelength routed network, linear light wave network. 6 (L)

UNIT 3: Issues in wavelength routed network, Routing and wavelength assignment, Wavelength convertible networks, Multifiber networks, Virtual topology design, Virtual topology reconfiguration, Survivable networks, Optical multicast routing, Network control and management. 8 (L)

UNIT 4: Transmission impairment, Ring networks and traffic grooming, VPN over WDM Optical network, Access network and Next generation optical Internet Networks, Introduction of All Optical Network. 6 (L)

Text/Reference Books

- R. Ramaswami, & K. N. Sivarajan, "Optical Networks a Practical perspective", Morgan Kaufmann Publishers, 3rd Ed.
- B. Mukherjee, *Optical Communication Networks*, New York, NY: McGraw-Hill, July 1997.
- U. Black, "Optical Networks: Third Generation Transport Systems"/ Pearson Educations
- Biswanath Mukherjee "Optical WDM Networks" Springer Pub 2006.
- "Fiber Optic Communication System", G. P. Agrawal, John Wiley, NY

MULTIMEDIA COMMUNICATION (EC-1843)

UNIT 1: Multimedia Communications- Introduction, information representation, networks, Applications and networking terminology, multimedia Information Representation-text, images, audio, video 6(L)

UNIT 2: Text and Audio Compression- Huffman coding, Arithmetic coding, LZ coding.. Audio compression-Linear predictive coding, perceptual coding, MPEG audio coder. 6(L)

UNIT 3: Image and Video Compression- JPEG, Wavelet based image compression Video compression- Video compression principle, H.261, H.263, MPEG video coders. 6(L)

UNIT 4: Standards for Multimedia Communications- Reference models, interpersonal communication. Interactive applications over internet, e-commerce Entertainment applications, video-on-demand, interactive television transmission media, Asynchronous & synchronous transmission, Error detection methods, Protocol basics. 6(L)

UNIT 5: Multimedia Networks Circuit-Switched Networks- DSL, switching systems, signaling systems. Broadband ATM networks- switch architecture, protocol architecture ATM LANs, ATM MANs, wide area ATM networks. Enterprise Network- LAN, FDDI LAN protocols. Entertainment Networks- Cable TV network, and satellite TV networks 8(L)

UNIT 6: Multimedia Information Security Support Functions- ASN.1, security, data encryption, authentication, data hiding, watermarking, network security. 4(L)

UNIT 7: Internet Applications- IP datagram, routing algorithms ICMP, QoS support, IPv6 , DNS, E-mail, FTP, TFTP, Wi-Fi Internet ,internet telephony, Multimedia over wireless networks (satellite, 3G, WiMAX) 4(L)

Text/Reference Books:

- Multimedia Communications: Applications, Networks, Protocols and Standards by Fred Halsall, Preason Education, 4th Ed.
- Introduction to Data Compression by Khalid Sayood
- Multimedia Communication Technology by Jens-Rainer Ohm
- Data Communications & Networking by Forouzan
- Data Hiding Fundamentals & Applications: Content Security in Digital Multimedia by Husrev T. Sencar, Ramkumar & Ali N. Akansu, Springer, 1st Ed.

MIXED - MODE SIGNAL PROCESSING (EC-1844)

UNIT 1: Active & Passive elements- GIC, FDNR, NIC realizations, Immittance & Inductor Simulation, Deboo circuits & Riordan Gyrators, Current Conveyors (CC^{+} & CC^{++}), FTFN & CFAs, Generalized active RC realizations, Delyiannis-Friend Circuits, Multiple VCVS & KHN realizations using CFAs, state variable & switched capacitor filters, Relative sensitivity, Pole position & coefficient (Q, W_n) sensitivity, spread considerations. 12(L)

UNIT 2: Basic CMOS Circuit Techniques & Current mode signal processing- Mixed-signal VLSI chips-Basic CMOS Circuits-Basic Gain Stage-Gain Boosting Techniques-Super MOS Transistor, MOS Multipliers and Resistors-CMOS, Bipolar and Low-Voltage BiCMOS building block, Continuous time signal processing, Current Mode low power Neural Networks signal processing blocks. 12(L)

UNIT 3: Mixed- Signal Circuits, Nonlinear Analog Circuits, Dynamic Analog Circuits, Sampled-Data Analog Filters, Over Sampled A/D Converters, D/A Converters and Analog Integrated Sensors: First –order and Second SC Circuits-Bilinear Transformations 4(L)

UNIT 4: Digital Tuning /Digital Programmability- SPRA/SPCA (switched programmable resistor array & switched programmable capacitor array), m-DAC (Multiplier-DA converter) and their interfacing to microcontroller/micro computer system, digitally programmable active RC network using high speed analog/ mixed- signal building block. 12(L)

Text/Reference Books

- Mohammed Ismail, Terri Fiez, "Analog VLSI signal and Information Processing ", McGraw-Hill International Editions, 1994.
- Malcom R. Haskard, Lan C.May "Analog VLSI Design- NMOS and CMOS", Prentice Hall, 1998.
- Randall L Geiger, Phillip E. Allen, "Noel K.Strader, VLSI Design Techniques for Analog and Digital Circuits", Mc Graw Hill International Company, 1990.
- Jose E. France, Yannis Tsividis, "Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.
- C.Toumazou, F.J.Lidgey & D.G. Haigh, Analog IC Design. The Current-Mode Approach, Peter Peregrinus Ltd., 1990.

ADVANCED DIGITAL SIGNAL AND IMAGE PROCESSING (LAB) (EC-1851)

Experiment 1: Speech Processing

A speech processing experiment, separated to two parts:

- In this experiment the students will become familiar with speech signals, their statistical properties and with a model that represents the production of such a signal.
  An encoder-decoder system will be built and tested using Matlab.
- The blocks that assemble such systems are a VAD (Voice Activity Detection), a voiced/unvoiced classifier, a pitch (the basic frequency of speech) detector and a parametric model of a speech signal.

Experiment 2: Real-time Implementation of Digital Filters

A Real-Time experiment, based on Texas Instrument's TMS320c6713, A well known and wide used DSP. The experiment is separated into two parts:

- Digital filter (FIR) design, with special attention to quantization and fixed-point implementation.
- Comparison of FIR and IIR filters design, with DFT/FFT usage example, by tuning piano tones.

Experiment 3: Image Compression

In this experiment the students will become familiar with the basics and principles of image processing and compression techniques, specifically with the well known and widely used JPEG standards. The experiment is separated into two parts:

- Feature extraction and other image processing operations
- Image basics, terminology and techniques used for image processing and compression are learned. This part includes a "JPEG-like" Matlab based implementation of these basic ideas.

Experiment 4: Wavelet and Multirate Signal Processing

- Up-sampler and down-sampler, filters in sampling rate alternation systems; multi-stage design of decimator and interpolator, polyphase decomposition; arbitrary sampling rate converter, digital filter banks, uniform DFT filter banks, Wavelet transform and its applications.

PROJECT (EC-1891)