Course Structure & Syllabus

of

B.Tech Programme

in

Electronics & Telecommunication Engg.

(From the Session 2015-16)

VSSUT, BURLA

FIRST SEMESTER	SECOND SEMESTER

Theory		Contact Hrs.	CR	Theory		Contact Hrs.	CR
Course Code	**Subject**	L .T .P		**Course Code**	**Subject**	**L. T. P**	
	Mathematics - I	3 - 1 - 0	4		Mathematics - II	3 - 1 - 0	4
	Physics/Chemistry	3 - 1 - 0	4		Chemistry/ Physics	3 - 1 - 0	4
	Engineering Mechanics/ Computer Programming	3 - 1 - 0	4		Computer Programming/ Engineering Mechanics	3 - 1 - 0	4
	Basic Electrical Engineering/ Basic Electronics	3 - 1 - 0	4		Basic Electronics/ Basic Electrical Engineering	3 - 1 - 0	4
	English for Communication/ Environmental Science	3 - 1 - 0	4		Environmental Science/ English	3 - 1 - 0	4
Sessionals				**Sessionals**			
	Applied Physics Laboratory/Chemistry Lab	0 - 0 - 3	2		Chemistry Lab/Applied Physics Laboratory	0 - 0 - 3	2
	Workshop-I/ Engineering Drawing	0 - 0 - 3	2		Engineering Drawing/ Workshop-I	0 - 0 - 3	2
	Basic Electrical Engg. Lab/ Basic Electronics Lab	0 - 0 - 3	2		Basic Electronics Lab/ Basic Electrical Engg. Lab	0 - 0 - 3	2
	Business Communication Skill/ Programming Lab	0 - 0 - 3	2		Programming Lab/ Business Communication Skill	0 - 0 - 3	2
	Total	**15-5-15**	**28**		**Total**	**15-5-15**	**28**

COURSE STRUCTURE

FIRST YEAR

(COMMON TO ALL BRANCHES)

SECOND YEAR

THIRD SEMESTER				FOURTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	**Subject**	**L-T-P**		**Course Code**	**Subject**	**L-T-P**	
	Mathematics-III	3 - 1 - 0	4		Mathematics-IV	3 - 1 - 0	4
	Analog Electronics Circuits-I	3 - 1 - 0	4		Digital Electronics Circuits	3 - 1 - 0	4
	Network Analysis and Synthesis	3 - 1 - 0	4		Analog Communication Techniques	3 - 1 - 0	4
	Electrical Machines	3 - 1 - 0	4		Analog Electronics Circuits-II	3 - 1 - 0	4
	Engineering Economics	3 - 1 - 0	4		Organizational Behavior	3 - 1 - 0	4
Sessionals				Sessionals			
	Analog Electronics Circuits Lab.	0 - 0 - 3	2		Digital Electronics Circuits Lab.	0 - 0 - 3	2
	Signal Analysis and Synthesis Lab.	0 - 0 - 3	2		Analog Communication Techniques Lab.	0 - 0 - 3	2
	Simulation Lab-I	0 - 0 - 3	2		Design and Testing Lab.	0 - 0 - 3	2
	Electrical Machines Lab.	0 - 0 - 3	2		Simulation Lab. - II	0 - 0 - 3	2
	Total	**15-5-12**	**28**		**Total**	**15-5-12**	**28**

THIRD YEAR

FIFTH SEMESTER				SIXTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	**Subject**	**L-T-P**		**Course Code**	**Subject**	**L-T-P**	
	Digital Communication Technique	3 - 1 - 0	4		Electronic Measurements and Measuring Instruments	3 - 1 - 0	4
	Digital Signal Processing	3 - 1 - 0	4		Microwave Engineering	3 - 1 - 0	4
	Electromagnetic Field Theory	3 - 1 - 0	4		Digital Image Processing	3 - 1 - 0	4
	Microprocessors	3 - 1 - 0	4		Microcontroller and Embedded systems	3 - 1 - 0	4
	VLSI Design	3 - 1 - 0	4		Core Elective	3 - 1 - 0	4
Sessionals				Sessionals			
	Digital Communication Technique Lab.	0 - 0 - 3	2		Instrumentation Lab.	0 - 0 - 3	2
	Digital Signal Processing Lab.	0 - 0 - 3	2		Microwave Lab.	0 - 0 - 3	2
	Microprocessors Lab.	0 - 0 - 3	2		Microcontroller Lab.	0 - 0 - 3	2
	VLSI Design Lab.	0 - 0 - 3	2		Digital Image Processing Lab.	0 - 0 - 3	2
	Total	**15-5-12**	**28**		**Total**	**15-5-12**	**28**

FOURTH YEAR

SEVENTH SEMESTER				EIGHTH SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	**Subject**	**L-T-P**		**Course Code**	**Subject**	**L-T-P**	
	Communication System Engineering-I	3 - 1 - 0	4		Communication System Engineering-II	3 - 1 - 0	4
BEE	Control Systems	3 - 1 - 0	4		Antenna Engg.	3 - 1 - 0	4
	Computer Communication & Networking	3 - 1 - 0	4		Open Elective	3 - 1 - 0	4
	Core Elective	3 - 1 - 0	4				
	Open Elective	3 - 1 - 0	4				
Sessionals				**Sessionals**			
	Minor Project	0 - 0 - 3	2		Seminar	0 - 0 - 0	2
	Communication System Lab.	0 - 0 - 3	2		Comprehensive Viva	0 - 0 - 0	2
					Major Project	0 - 0 - 6	8
	Total	**15-5 - 6**	**24**		**Total**	**9 - 3 - 6**	**24**

LIST OF CORE & OPEN ELECTIVE SUBJECTS (B.Tech)

LIST OF CORE ELECTIVES		LIST OF OPEN ELECTIVES	
Course Code	Subject	Course Code	Subject
	Wireless Communication		Information Theory & Coding
	Intelligent Instrumentation		Opto-electronics Devices
BEE	Optimal & Adaptive Control System		Mobile Computing
	Soft Computing		Advanced Digital Signal Processing
	Nanotechnology		Biomedical Instrumentation
	DSP Architecture		Cryptography & Network Security
	High Level VLSI Design		Low Power VLSI Design
BEE	Industrial Electronics		Digital Switching and Telecommunication Network

LIST OF ADDITIONAL OPEN ELECTIVES OFFERED BY OTHER DEPARMENTS

Course Code	**Subject**	**Offered by Deparments**
	Industrial Management	Mechanical Engg.
	Cloud Computing	Comp. Science & Engg.
	AI and Robotics	Comp. Science & Engg.
	Database Management System	Comp. Science & Engg.
	Mechatronics	Production Engg.

SYLLABUS

FIRST & SECOND SEMESTER

(COMMON TO ALL BRANCHES)

PHYSICS – I (3 – 1 – 0)

Module I

Interference

Superposition of waves - coherent and incoherent superposition, Intensity distribution.

Two source interference theory, Interference in thin films. Newton's Rings, Determination of wavelength of light and refractive index of liquid.

Diffraction

Diffraction: Introduction, Types of diffraction ,Fraunhofer diffraction at a single slit,Plane Diffraction grating,Diffraction spectra, Determination of wavelength of light, angular dispersion, resolving power.

Polarization

Polarization: Introduction, Types of Polarization, Production of polarized light(elementary idea) Brewster's law, Malu's law, Double refraction(only statement, explanation), Construction and working of :Nicol prism, Half wave plate and Quarter wave plate, Application of polarization(Polrimeter:Construction,Principle,Working).

Module II

Electromagnetism

Vector Calculus : Gradient, Divergence, Curl of vector field, Gauss divergence theorem. Stoke's theorem, Green's theorem,Maxwell's electromagnetic equation in differential form and in integral form , Electromagnetic wave equation: in vacuum and in conducting medium. Pyonting vector ,Pyonting theorem, preliminary ideas about waveguides.

Module III

Quantum mechanics

Need for Quantum Physics, wave particle duality,Davisson Germer experiment, Schroedinger wave equation (time dependent and time independent), properties of wave function, Operators , eigen value , eigen function, expectation value, probability current, Simple applications: particle in a box, finite well, step potential and tunneling

Module IV

Lasers

Introduction, Characteristics of lasers, Einstein's coefficients & Relation between them, Lasing action, Population inversion, Different types of Lasers (Ruby Laser,He-Ne Laser), Three and Four level pumping schemes, Applications of LASER(elementary ideas)

Fiber optics

Introduction, Principle of wave propagation in Optical Fiber, Structure of Optical Fiber,Types of Optical Fibers, Acceptance angle and acceptance cone, Numerical aperture, Applications of optical fibers in communications

Nanomaterials

Introduction, Classification, Physical characteristics and applications (fundamental)

Text books:

1. Optics – A.K.Ghatak
2. Concepts of Modern Physics – A. Beiser

Reference Books:

1. Electricity & Magnetism – D. Griffiths
2. Quantum Mechanics – Gascirowicz

3. Lasers, theory and applications - K. Thyagarajan and A.K. Ghatak, New York : Plenum Press.
4. Quantum Mechanics – M. Das and P.K Jena
5. An Introduction to Fiber Optics - A.Ghatak, K.Thyagarajan: Cambridge University Press.
6. .Nano Materials by B.Viswanathan,Narosa Book Distributer

List of Experiments

1. To Determine the Young's Modulus (Y) of the material of a Wire by Searle's Method.
2. Determination of Surface Tension of water by Capillary rise method.
3. Determination of Acceleration due to gravity by using a Bar Pendulum.
4. To determine thermal conductivity of a bad conductor by using Lee's Apparatus.
5. Determination of Wavelength of monochromatic light with the help of a Newton's Ring Apparatus.
6. Determination of Grating element of a Diffraction grating using spectrometer.
7. To verify the laws of transverse vibration of string by using sonometer.
8. To determine the Rigidity modulus of the material of a wire by using Barton's apparatus.
9. To draw the characteristics of a Bipolar Junction Transistor.
10. To draw the V-I characteristics of a P. N Junction diode.

CHEMISTRY – I **(3 – 1 – 0)**

Module–I 10 Hours

Failure of Classical Mechanics, Schrodinger's Wave Equation (Need not be Derived), Energy for 1-D Potential Box, Interaction of Wave with Matter
Fundamental of Microwave, IR, UV-Vis Spectroscopy:
Basic Concept of Spectroscopy, Selection Rule, Numericals, Frank-Condon Principle,

Module – II 10 Hours

Thermodynamics of Chemical Processes: 05 Hours
Concept of Entropy, Chemical Potential, Equilibrium Conditions for Closed Systems, Phase and Reaction Equilibria, Maxwell Relations

Module – III 10 Hours

Definition of Terms: Phase, Components, Degree of Freedom, Phase Rule Equation. Phase Diagrams: One Component Systems – Water and Sulphur, Two Component System – Lead-Silver, Cooling Curves, Iron-Carbon Phase Diagram

Module–IV 10 Hours

Electrode Potentials and its Relevance to Oxidation and Reduction, Measurement of EMF, Determination of pH, Hydrogen, Glass, Quinhydrone Electrodes, Dry Cells, Fuel Cells and Corrosion: Concept, Galvanic Corrosion
Kinetics of Chemical Reactions: 05 Hours
Reversible, Consecutive and Parallel Reactions, Steady State Approximation, Chain
Engineering application of materials: 05 Hours
Organometallics and Nanomaterials

1) P. W. Atkins, Elements of Physical Chemistry, 4th Edition, Oxford University Press
2) C. N. Banwell and E. M. MacCash, Fundamentals of Molecular Spectroscopy, 5th Edition,
3) P. K. Kar, S. Dash and B. Mishra, B.Tech. Chemistry Vol. I, Kalyani Publications

Chemistry Laboratory

(Any ten Experiments)

1. Determination of amount of sodium hydroxide and sodium carbonate in a Mixture.
2. Determination of Total hardness of water by EDTA method.
3. Estimation of calcium present in the limestone.
4. Preparation of aspirin.
5. Standardization of $KMnO_4$ using sodium oxalate.
6. Determination of ferrous iron in Mohr's salt by potassium permanganate.
7. Determination of Rate constant of acid catalyzed hydrolysis of ester.
8. Determination of dissolved oxygen in a sample of water.
9. Determination of Viscosity of lubricating oil by red wood Viscometer.
10. Determination of Flash point of given oil by Pensky Marten's Flash point Apparatus.
11. Determination of available chlorine in bleaching powder.

Reference Book: B.Tech practical Chemistry-Kalyani publisher

MATHEMATICS - I

Subject – Mathematics I (Calculus, Linear Algebra and Numerical Method) (3-1-0)

Module 1: (10 Lectures)

Open sets, Closed sets, Limit points of a set, Limits, Continuous functions, Functions continuous on closed intervals, The derivative, Increasing and decreasing functions, Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Extremum values; Riemann integral: Definition and existence of the integral, Integral as a limit of sums, some integrable functions, Fundamental theorem of calculus, Mean value theorems for integral calculus.

Module 2: (10 Lectures)

Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination, Linear Independence, Rank of a Matrix, Vector Space, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Gauss-Jordan Elimination, Vector Spaces, Inner Product Spaces,

Module 3: (10 Lectures)

Eigenvalues, Eigenvectors, Some Applications of Eigenvalue Problems, Symmetric, Skew-Symmetric, and Orthogonal Matrices, Eigenbases, Diagonalization, Quadratic Forms, Complex Matrices and Forms, IncIusion of Matrix Eigenvalues, Power Method for Eigenvalues

Module 4: (10 Lectures)

Numerical methods in general, Introduction, Solution of Equations by Iteration, Interpolation, Numerical Integration and Differentiation

Text Books:

1) S.C. Malik and S. Arora, Mathematical Analysis, New Age International
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: S.C. Malik - 2(2.1- 2.3), 5(5.1-5.3), 6(6.1, 6.3-6.7), 7(7.1), 9(9.1, 9.6, 9.7, 9.9,9.10)
E. Kreyszig - 7(7.1-7.5, 7.7, 7.8,7.9), 8, 20 (20.7, 20.8), 19(19.1, 19.2, 19.3, 19.5)

Reference Books:

1) George B. Thomas , Jr. and Ross L. Finney, Calculus and Analytic Geometry, Addison Wesley Publishing Company
2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

MATHEMATICS - II

Differential Equations (3-1-0)

Module 1: (10 Lectures)
Basic Concepts, Modeling, Separable ODEs, Modeling, Exact ODEs, Integrating Factors, Linear ODEs, Bernoulli Equation, Population Dynamics, Existence and Uniqueness of Solutions. Homogeneous Linear ODEs of Second Order, Homogeneous Linear ODEs with Constant Coefficients, Euler-Cauchy Equations, Existence and Uniqueness of Solutions, Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters.

Module 2: (10 Lectures)
General linear differential equations of order n, Differential Operators, Homogeneous Linear ODEs, Homogeneous Linear ODEs with Constant Coefficients, Nonhomogeneous Linear ODEs, Conversion of an nth-Order ODE to a System, Basic Theory of Systems of ODEs.

Power Series Method, Theory of the Power Series Method, Frobenius Method, Sturm-Liouville Problems, Orthogonal Functions.

Module 3: (10 Lectures)
Laplace Transforms, Laplace Transform, Inverse Transform, Linearity. s-Shifting, Transforms of Derivatives and Integrals, ODEs, Unit Step Function, t-Shifting, Short Impulses, Dirac's Delta Function, Partial Fractions, Convolution, Integral Equations, Differentiation and Integration of Transforms.

Module 4: (10 Lectures)
Partial differential equations, Basic Concepts, Modeling: Vibrating String, Wave Equation Solution by Separating Variables, Use of Fourier Series, D' Alembert's Solution of the Wave Equation. Characteristics, Heat Equation: Solution by Fourier Series, Solution of PDEs by Laplace Transforms.

Text Book:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd, 9th edition.

Chapters: 1(1.1-1.5, 1.7), 2(except 2.4, 2.8, 2.9), 3, 4(4.1, 4.2), 5(5.1, 5.2, 5.4), 6(6.1-6.5), 12(12.1-12.5, 12.11)

Reference Books:

1) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
2) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press
3) J. Sinha Roy and S. Padhy, Ordinary and Partial Differential Equation, Kalyani Publisher.
4) Richard Bronsan and Gabriel Costa, Scahum's Outline of Differential Equations, McGraw Hill
5) Paul Duchateau and D.W. Zachmann, Scahum's Outline of Partial Differential Equations, McGraw Hill
6) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill

English for Communication

(Credit: 4-0-0)

Objective- For developing the ability to communicate effectively in professional environment by enhancing their skills in communication.

Module 1:Fundamentals of Communication (10 Hours)

- Communication:Process, pattern and stages of communication, channels and types of communication and Barriers to Communication.
- Functions of language: Descriptive, Expressive and Social Functions.
- Formal and Informal English
- Plain English
- Bias free language

Module 2: Communicative Grammar (10 Hours)

- Time, Tense and Aspects
- Verbs of State and Events
- Use of Modal Verbs
- Phrasal Verbs
- Passive and Active Voice
- Conditionals

Module 3: Sounds of English (10 Hours)

- The Speech Mechanism and Organs of Speech
- ConsonantSounds of English
- Vowel Sounds of English
- Stress Pattern: Syllable, Stress and Intonation.
- Problem sounds for Indian Speakers

Module 4: Business and Official Writing (10 Hours)

- Paragraph writing and Sentence Linker
- Business and Official Letters
- Report and Proposal writing,
- Notice, Circular and Memo writing
- Résumé (CV) Writing.

Text Books:

1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Better English Pronunciations By J. D.O Conner (Cambridge University Press)
3. A Communicative Grammar of English by G.N. Leech and Jan Svartik (OUP)

Reference Books: "Business communication" by Ramachandran, Lakshmi and Krishna (Macmillan)

ENGLISH COMMUNICATION SKILLS (Credit :0-0-2)

Objective: For enhancing corporate readiness among students by inculcating several skills of communication through activities.

Laboratory Activities:

1. **Giving Introduction (Self and others)**
2. **Group Discussion**
3. **Interviews**
4. **Role Play**
5. **Listening skill Development**
6. **Reading skill Development**
7. **Writing skill Development**
8. **Speaking skill Development**
9. **Meeting**
10. **Presenatation**

Books Recommended:

1. Soft Skills – By Dr K Alex (S Chand)

ENGINEERING MECHANICS

Module - I

1. **Concurrent forces on a plane**: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment, friction (chapter 1). (7)
2. **Parallel forces on a plane**: General case of parallel forces, center of parallel forces and center of gravity, centroid of composite plane figure and curves(chapter 2.1 to 2.4) (4)

Module - II

3. **General case of forces on a plane**: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections, plane frame, principle of virtual work, equilibrium of ideal systems.(8)
4. **Moments of inertia**: Plane figure with respect to an axis in its plane and perpendicular to the plane, parallel axis theorem(chapter 3.1 to3.4, 5.1, appendix A.1 to A.3) (3)

Module - III

5. **Rectilinear Translation:** Kinematics, principle of dynamics, D Alembert's Principle, momentum and impulse, work and energy, impact (chapter 6). (11)

Module – IV

6. **Curvilinear translation:** Kinematics, equation of motion, projectile, D Alembert's principle of curvilinear motion. (4)
7. **Kinematics** of rotation of rigid body (Chapter 9.1) (3)

Text book:

1. Engineering mechanics: S Timoshenko & Young; 4th Edition (international edition) MC Graw Hill.

Reference books:

1. Fundamental of Engineering mechanics (2nd Edition):
   S Rajesekharan & G Shankara Subramanium; Vikas Pub. House Pvt ltd.

2. Engineering mechanics: K.L. Kumar; Tata MC Graw Hill.

SESSIONAL

Workshop -I

(Consists of 3 sections) **:**

1. Carpentry Section: Wooden rack/bench/chair/stool (any one)
2. Fitting Section: Paper Wt. Square or Rectangular joint (male and female joint) (any one)
3. Black Smith **Section** : Weeding hook/Hexagonal headed bolt blank (any one)

COMPUTER PROGRAMMING

L-T-P: 3-1-0 **Cr.-4**

Module I:

Introduction to computing- Block architecture of a computer, bit, bytes, memory, representation of numbers in memory. Introduction to problem solving- Basic concepts of an algorithm, program design methods, flowcharts.C Language Fundamentals- Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements.Input &Output - Input & Output Assignments, Formatted Outputs. Operatorsand Expressions-Operators, Precedence of operators.

Module II:

Decision Control Structure, Loop Control Structure and Case Control Structure.Functions- Monolithic vs Modular programs, User defined vs standard functions, formal vs Actualarguments, Functions category, function prototypes, parameter passing, Recursion.Arrays- 1D Array, 2D Array & Multi-Dimensional Array. Strings- Declaration &Initialization,String Handling Functions.

Module III:

Pointers- Pointer variable and its importance, Pointer Arithmetic, Passing parameters, pointer to pointer, pointer to function.Dynamic Memory Allocation.Structure- Nested Structure, Array of Structures, Pointer to Structure, Structure & Functions, typedef, Enumerated Data Type, Bit Fields. Union- Array of Union Variables, Union inside Structure.Storage Class.

Module IV:

Preprocessor Directives- Types, Pragma Directives, Conditional Directives.Files- Reading data from Files, Reading data from Files, Writing data to Files, Error Handling during File Operations.Advanced Issues in Input & Output – using *argc*&*argv*.Operation on Bits.

Text Books:

1. C: The Complete Reference: Herbert Schildt
2. Computer Fundamentals &Programming in C: ReemaThareja, Oxford University Press.

Reference Books:

1. Let us C- Y.Kanetkar, BPB Publications.
2. Programming with ANSI and Turbo C- Kamthane, A.N. Pearson Education
3. C How to Program- Deitel and Deitel, Pearson Education.
4. The C programming Language- Brian W. Kernighan and Dennis M. Ritchie,Prentice-Hall.

PROGRAMMING LAB (CS15-984)

L-T-P: (0-0-3) **Cr:** 2

Introduction to OS : Linux/Unix, Dos, Windows, Vi editor, File Handling, Directory Structure, File Permissions, Creating and editing simple c programs, Compilation and Execution
C programming on variables and expression assignment, simple arithmetic loops, If-else, Case statements, Break, Continue, Go to
Single and Multidimensional arrays
Functions, Recursion, File handling in C
Pointers, address operator, Declaring pointers and operators on pointers, Address of an array, Structures, Pointer to structure, Dynamic memory allocation
Fundamental Programs on Data Structures (Stack, Queue, Linked lists, Trees, Graphs)

(EL15-002) BASIC ELECTRICAL ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

DC Networks: Kirchhoff's laws, node and mesh analysis, Delta-star and star-delta transformations. Superposition, Thevenin's and Norton's theorem. Transients, in R-L, R-C and R-L-C circuits with DC. Excitation.

Single Phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, j- operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits. Introduction to resonance in series RLC circuit.

Three Phase AC Circuit: Three phase EMF generation, delta and star connection, Line and Phase quantities. Solutions of 3-phase circuits with balanced load. Power in 3-phase balanced circuits.

MODULE-II (10 HOURS)

Magnetic Circuits: B-H Curve, Hysteresis, Permeability and reluctance, solution of simple magnetic circuits, Hysteresis and Eddy current losses.

DC Generator: Different types, Principle of Operation of DC generator, EMF equation, methods of excitation. DC Motor: Back e.m.f., speed and torque of a DC Motor, Conditions for maximum Power. Speed control of DC shunt motor.

Transformers: Construction and Principle of operation of single-phase transformer, EMF equation, Single-phase autotransformer.

MODULE-III (10 HOURS)

Three phase Induction Motor: Construction and principle of operation, types; Slip-torque characteristics.

Synchronous Machines: Construction & principle of operation of Synchronous generator and motor. EMF equation, Voltage regulation, Applications and starting of Synchronous motor.

Introduction to single-phase induction Motor.

MODULE-IV (10 HOURS)

Measuring Instruments: DC PMMC instruments, Extension of range by shunts and multipliers. Moving iron ammeters and voltmeters, Dynamometer type Watt meters, Induction type Energy Meter.

Power supply systems: Principle of generation - thermal, hydel and nuclear. Transmission and distribution of electric energy. Introduction to Electric Heating & Welding.

TEXT BOOKS

[1]. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.

[2]. D.Kulshreshtha, " Basic Electrical Engineering" TMH, 1st Edition.

REFERENCE BOOKS

[3]. H.Cotton, "Advanced Electrical Technology", CBS Publishers, New Delhi, 7th Edition.

[4]. C.L. Wadhwa, "Electrical Engineering", New Age International Publishers, 2nd Edition.

[5]. S. Parker Smith, "Problems in Electrical Engineering", Asia Publications, 10th Edition.

(EL15-003) BASIC ELECTRICAL ENGINEERING LAB (0-0-3)

1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, To study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules as per ISS
2. Measurement of the armature & field resistance of D.C. Machine by volt-amp method. & Starting and speed control of a D.C. shunt motor
3. Study of BH Curve
4. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds.
5. Measurement of earth resistance and insulation resistance
6. Starting of Induction motor and measurement of three phase power & power factor by 2-wattmeter method.
7. Calibration of a single phase Energy Meter by directed loading & Phantom loading

BASIC ELECTRONICS (3-1-0)

UNIT-1 **(10 Hours)**

Introduction to Electronics: Signals, Frequency Spectrum of Signals, Analog and Digital Signals,
Linear Wave Shaping Circuits: RC LPF, Integrator, RC HPF, Differentiator.
Properties of Semiconductors: Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors,
Diodes: p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes- LED, Photo diode, Zener Diode.

UNIT-II **(14 Hours)**

Bipolar junction Transistor (BJTs): Device Structure and Operation, Current-Voltage Characteristics, BJT as an Amplifier and as a Switch, Introduction to Power Amplifiers, A,B and C types.
JFET: Physical Structure, Operation and Characteristics MOSFET: Physical Structure, Operation and Characteristics, Feedback Amplifiers & Oscillators: General Feedback Structure, Properties of Negative Feedback, Four Basic Feedback Topologies (block diagram only), Basic Principles of Sinusoidal Oscillators(Crystal, Hartley & Collpit).
Operational Amplifiers (OP-AMPs): The Ideal OP-AMP, Inverting Configuration, Non-Inverting Configuration. OP-AMP Applications (Adder, Subtractor, Integrator, Differentiator).

UNIT-III **(10 Hours)**

Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, RS Flip flop, JK Flip flop.

UNIT-IV **(10 Hours)**

Introduction to Electronic Instruments: CRO: CRT, Waveform Display, Applications of CRO, Electronic Multimeter, Audio Signal Generator: Block diagram, Front Panel Controls.
Principles of Communication: Fundamentals of AM & FM, Block diagram of Transmitters & Receivers.

TEXT BOOKS:

1. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press. Selected portions from chapters 1 to 3, 5, 8, 13.
2. Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, NewAge International Publications. Selected portions from chapters 4 to 12,14, 16 to 18,20,21.

REFERENCE BOOKS:

1. Integrated Electronics, Millman and Halkias, TMH Publications.
2. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.

BASIC ELECTRONICS LAB
LIST OF EXPERIMENTS

1. Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital multimeter should be used.
2. Study and use of CRO to view waveforms and measure its Amplitude and Frequency.
3. V-I Characteristics of a Semiconductor Diode. Determining DC and AC resistance.
4. Clipper and Clamper Circuit.
5. Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
6. V-I (Output) Characteristics of N-P-N Transistor in CE Configuration.
7. OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
8. Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)

CE 15001: ENVIRONMENTAL SCIENCE & ENGINEERING (3-1-0) CR-04

Module – I **(6 Hours)**

Components of Earth System: Lithosphere, Cryosphere, Atmosphere, Hydrosphere, Biosphere and Outer space.

Ecological concepts and natural Resources: Ecological perspective and value of environment, Environmental auditing, Biotic components, Levels of organizations in environment Ecosystem Process: Energy, Food chain, Environmental gradients, Tolerance levels of environmental factor.

Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative).

Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration.

Module – II **(15 Hours)**

Environmental Pollution: Definition, Causes, effects and control measures of: Water pollution, Air pollution, Noise pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards

Environmental Issues: Climate change, Global warming, Acid rain, Ozone layer depletion, Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print

National Ambient Air quality Standards, Noise standards, Vehicle emission standards

Module – III **(12 Hours)**

Drinking water standard (IS 10500), Water Quality Criteria and wastewater effluent standards

Water treatment: Water sources and their quality, Lay out of a water treatment plant and working of each unit/ principles of each process i.e. Screening, Aeration, Sedimentation, coagulation, flocculation, Filtration, Disinfection. Miscellaneous treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation. Advanced water treatment: Ion exchange, electro-dialysis, RO, desalination

Working principles of ready-made water filter/purification system commercially available

Lay out of a wastewater treatment plant and working of each unit.

Module – IV **(7 Hours)**

Solid waste management: Source, classification and composition of MSW, Storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological & thermal treatment (principles only), land fill

Biomedical Waste management – sources, treatment (principles only) and disposal

Hazardous Waste Management- Introduction, Sources, Classification, treatment (principles only)

Introduction to e-waste management.

Environmental impact Assessment: Project screening for EIA, Scoping studies

Environmental policies and acts (Air, Noise, Water, Forest, E-waste, Hazardous waste acts).

Text Book:

1 Environmental Engineering, G. Kiely, TMH, 2007

Reference Books:

1 Environmental Engineering, H.S. Peavy, D.R.Rowe and G. Tchobanoglous, McGraw Hill, 1985.

2 Introduction to Environmental Engineering, M. L. Davis and D. A Cornwell, McGraw Hill International, 2005.

CE 15002: ENGINEERING DRAWING (0-0-3) CR-02

(Minimum 8 sheets and 2 Auto Cad classes)

Introduction to Engineering Drawing: Drawing instruments, lines, lettering and dimensioning.

Scales: Plain, Diagonal and Vernier Scales.

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Orthographic Projections: Concepts, Orthographic projections of points, Lines, Planes and Solids.

Sections of solids; Development of surfaces

Isometric Projections: Principles, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and compound Solids,

Introduction to Auto-Cad:

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Text Book:

1 Engineering drawing by N.D. Bhatt and V.M Panchal, Charotar Publishing House, Anand.

Reference Books:

1. Engineering Drawing by Venugopal, New Age publisher.

THIRD SEMESTER

MATHEMATICS - III

Multivariable Calculus and Special Functions (3-1-0)

Module 1: (10 Lectures)

Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field; Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence Theorem of Gauss, Further Applications of the Divergence Theorem, Stokes's Theorem.

Module 2: (10 Lectures)

Fourier series and integral, Dirichlet criterion, Parseval's identity, the convolution theorem.

Module 3: (10 Lectures)

Orthogonal curvilinear coordinates, Jacobians, gradient, divergence, curl and Laplacian in curvilinear coordinates, Special curvilinear coordinates.

Module 4: (10 Lectures)

Gama function, The Beta function – Dirichlet integral; Other special functions– Error function, exponential integral, sine and cosine integrals, Bessel's Equation, Bessel Functions $J_{\square}(x)$, Bessel Functions of the Second Kind $Y_{\square}(x)$, Legendre's Equation, Legendre Polynomials $P_n(x)$.

Text Books:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd
   Chapters: 5(5.3, 5.5, 5.6), 9(9.4, 9.7, 9.8, 9.9), 10, 11(11.1-11.3, 11.6, 11.7), A3.4, A3.1

Reference Books:

1) S.C. Mallik and S. Arora, Mathematical Analysis, New Age International
2) Milton Abramowitz and Irene A. Stegun, *Handbook of Mathematical Functions*, National Bureau of Standards, Applied Mathematics Series - 55
3) **Yury A. Brychkov, Handbook of Special Functions: Derivatives, Integrals, Series and Other Formulas, CRC Press**
4) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
5) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

ANALOG ELECTRONICS CIRCUITS - I: (3-1-0)

Module-I (10 Hours)

BJT DC Analysis, Load lines, Operating Point, Fixed bias ,Emitter bias, Voltage-divider bias. DC bias with voltage feedback, Bias stabilization, Design of bias.

Amplification in AC domain, BJT transistor modelling , The r_e transistor model, Low frequency small signal analysis of CE(fixed bias, voltage divider bias, emitter bias), Effects of R_S and R_L, Analysis of transistor amplifier using Hybrid equivalent model, Graphical determination of h-parameters, Approximate conversion formulae of various configurations.

Module-II (10 Hours)

$I_D - V_{DS}$ characteristics of MOSFET, MOSFET circuits at DC.

DC Biasing of MOSFETs: Biasing by fixing V_{GS}, Biasing by fixing V_G and connecting a resistance in source, Biasing using drain to gate feedback resistor

MOSFET Small Signal operation and models: DC bias point, signal current in Drain terminal, Voltage gain, Separating DC analysis and signal analysis, Small signal equivalent models, Transconductance g_m

Single-stage MOSFET Amplifiers: Common-Source (CS) amplifiers, Common-Source amplifiers with a source resistance, Common-Gate (CG) amplifiers, Common-Drain (CD) or Source follower amplifiers.

Module-III (8 Hours)

BJT Frequency Response: Decibel, General frequency considerations, normalization process, Low frequency analysis of R-C combination in single stage BJT amplifier- Bode Plot, Miller Effect Capacitance, High frequency response of BJT Amplifier, Square Wave testing of amplifiers.

Compound Configurations: Cascade, Cascode and Darlington connections, Current Source Circuits, Current Mirror Circuit, Differential amplifier Circuit.

Module-IV (12 Hours)

Feedback and Oscillator Circuit: Feedback concept, feedback connections types and their analysis, Practical feedback circuit, Positive feedback circuit as Oscillator, Barkhausen's criteria for oscillation, R-C phase shift oscillator and Wien Bridge Oscillator.

Operational Amplifiers: OP-AMP Specifications, DC offset parameters, frequency parameters, Gain-bandwidth, Slew rate, Differential and Common mode operation, OP-AMP Applications: Constant gain multiplier, Voltage Buffer, Controlled sources.

Power Amplifiers: Class A, Class B, Distortion Analysis

Voltage Regulators: Transistor series voltage regulator, OP-AMP voltage regulators

Text Books:

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, 10th Edition Pearson Publication
2. Microelectronic Circuits – Sedra & Smith, 5th Edition, International Student Edition

Refernce Books:

3. Millman's Integrated Electronics –Jacob Millman and Christos Halkias, Chetan D Parikh, 2nd Edition Mcgraw Hill
4. Electronic Devices – Floyd, Pearson Education

NETWORK ANALYSIS AND SYNTHESIS (3-1-0)

Module-I (9 Hours)

FUNCTIONS AND NETWORK THEOREMS: The Concept of Complex Frequency, Transform Impedance and Transform Circuit, Series and parallel Combination of Elements, Review of Network Theorem.

TRANSIENTS: DC and AC analysis of RL, RC and RLC series circuits. Resonance: Series and Parallel resonance. Loop and node variable analysis, Waveform Synthesis-The Shifted Unit Step, Ramp and Impulse Function, Waveform Synthesis, The Initial and Final Value Theorems, The Convolution Integral.

Module-II (11 Hours)

IMPEDANCE NETWORK FUNCTIONS: POLES AND ZEROS: Terminal Pairs and Ports, Network Function for the One Port and Two Port, The Calculation of Network Function - (a) Ladder Network (b) General Networks. Poles and Zero of Network Functions, Restrictions on Pole and Zero Locations for Driving-Point Functions, Restrictions on Pole and Zero Locations for Transfer Functions, Time-domain Behavior from the Pole and Zero Plot, Stability of Networks.

TWO-PORT PARAMENTERS: Relationship of Two-Port Variables, The Hybrid parameters, Relationships Between parameter Sets, Parallel Connection of Two-Port Networks, Introduction to Graph Theory.

Module-III (12 Hours)

POSITIVE REAL FUNCTION: Properties of Positive Real Functions, Procedure for testing of PR function.

TESTING DRIVING-POINT FUNCTIONS: Properties of Hurwitz Polynomials, Procedure of testing for Hurwitz character, Concept of network synthesis, Reactive networks.

DRIVING-POINT SYNTHESIS WITH LC ELEMENTS: Properties of driving point immittances of LC network, Pole Zero Interpretation in LC networks. Elementary Synthesis Operations, LC NETWORK SYNTHESIS: Foster's canonic form and its significance, Cauer canonic form and its significance.

Module-IV (8 Hours)

RC AND RL NETWORKS. Properties of RC Network Function, Foster Form of RC Networks, Foster From of RL Networks, The Cauer Form of RC and RL Networks. Identification of an Immittance function in Cauer form of RC network.

Text Books:

1. Chapters 8, 9, 10 and 11 from Network Analysis, by M.E. Van Valkenburg, 3rd Edition, PHI.

2. Circuit Theory: Analysis and Synthesis, by A. K. Chakraborty, Dhanpat rai publication.

Reference Books:

1. A Course in Electrical Circuits and Analysis, by M.L. Soni and G.C. Gupta.

2. Network Analysis and Synthesis, by Franklin F. Kuo.

ELECTRICAL MACHINES - (3-1-0)

MODULE-I **(10 HOURS)**

Electromechanical Energy conversion, forces and torque in magnetic field systems – energy balance, energy and force in a singly excited magnetic field system, determination of magnetic force, energy, multi excited magnetic field systems.

DC Generators – Principle of operation, Action of commutator, constructional features, lap and wave windings, E. M.F. Equation, Methods of Excitation, Load characteristics of shunt, series and compound generators, parallel operation of DC generators

MODULE-II **(10 HOURS)**

Transformers: Single phase transformer, Constructional details, principle of operation, emf equation, magnetizing current and core losses, no load and on load operation, Phasor diagram, equivalent circuit, losses and efficiency, voltage regulation,Autotransformers, saving of copper

DC Motors: Principle of operation, Back E.M.F., Torque equation, characteristics and application of shunt, series and compound motors, Armature reaction and commutation, Starting of DC motor, 3 point starter,calculation of efficiency,Speed control of DC Motors: Armature voltage and field flux control methods, Ward Leonard method.

MODULE-III **(14 HOURS)**

Fundamental Principles of A.C. Machines: E.M.F. equation, Single & three Phase, relation between speed & frequency, armature reaction, the rotating field leakage reactance

Synchronous Generator: Various types & construction, cylindrical rotor theory, phasor diagram, open circuit & short circuit characteristics, armature reaction reactance, synchronous reactance, load characteristics,

Synchronous Motor: General Physical consideration, torque and power relations in non-salient pole and salient pole motors,

Single phase induction motor, theory of operation, Methods of starting, Elementary idea about three phase induction motors & its various types

MODULE-IV **(06 HOURS)**

Elementary idea about Single phase series motor, Schrage motor, Universal motor, Printed Circuit DC Motor, Stepper Motor, Brushless Motor, etc.

TEXT BOOKS

[1]. A. E. Fritzgerald, C. Kingsley, and S. Umans, “Electric Machinary”, TMH Publishers, 6th Edition.

[2] Electric Machines by I.J. Nagrath& D.P. Kothari, TMH Publishers, 4th Edition.

REFERENCE BOOKS

[1]. A. E. Clayton, N. Hancock, “Performance and Design of Direct Current Machines”, CBS Publishers, 1st Edition.

[2]. M. G. Say, “Performance and Design of Alternating Currentmachines”, CBS Publishers, 3rd Edition

[3] A. S. Langsdorf, “Theory of Alternating Current Machinery”, TMH Edition.

[4] E. O. Taylor, “The Performance & Design of A.C. Commutator motors”, Wheeler Publishing, New Delhi.

HUM01 ENGINEERING ECONOMICS (4-0-0)

MODULE- 1

Theory of Demand- Modern Utility Theory, The Neumann- Morgenstern approach, The Friedman-Savage Hypothesis, Uncertainty and Consumer Behaviour, Expected value of Perfect Information, Revealed Preference Theory, Intertemporal Choice- Slutsky equation, Annual Economic Worth, Present Value, Discount rate IRR and NPV

MODULE- 2

Profit Maximisation: Theory of Production- Laws of Production, Returns to scale and variable proportions, Equilibrium of firm, and Choice of optimal combination of factors, Cost Minimisation- Calculus analysis of cost minimisation, Algebric approach to cost minimisation, average and marginal costs- the short run Cobb- Douglas cost function, constant returns to scale and cost functions, Long run and short run curves- factor prices and cost functions , The envelop theorem for constrained optimisation , Cost control techniques, Critique of the principle of profit maximisation and Modern theories of firms- Baumol's sales maximisation hypothesis, Morris Model of Managerial Enterprise, Hall and Hitch Report and the full cost pricing principle, Bain's limit pricing theory

MODULE- 3

Analysis of Public Projects: Benefit cost analysis, Public goods, Common Property, Free Rider Problem, market failure and externalities, private and social cost, Social Welfare Functions- Welfare maximisation and pare to optimality, market responses to externalities- Mergers, social conventions, property right and bargaining case theorem

MODULE- 4

Linear models: simple regression model -the problem and estimation, classical normal linear regression model, Two- Variable regression- Internal estimation and hypothesis testing, Multiple Regression analysis- The problem of estimation, Dummy Variable Regression Models, Multiple parameter sensitivity analysis, linear Programming- graphic and simplex method; Game theory- the pay off matrix of game, Nash Equilibrium, the mixed strategies and the prisoner's dilemma

READING LIST

1. Varian, H.R. (1992). Introduction to Micro Economic Analysis, Norton and company, New York
2. Woolridge, J.M. (2009). Introductory Econometrics- A Modern Approach, South Western CENGAGE learning
3. Pearce, D.W. and Turner.(1990). Economics of Environment and Natural Resources, Harvester Wheatsheaf. New York
4. Koutsoyiannis, A.(1979). Modern Micro Economics, Macmillan, London
5. Damodaran, S. (2012). Managerial Economics, second Edition, OUP
6. Gujrati and Sangeeta. (2007). Basic Econometrics, TMH, New Delhi
7. Kolstad, C.D. (2000). Environmental Economics, OUP

ANALOG ELECTRONICS CIRCUITS LAB: (0-0-3)

1. Study of biasing circuits of BJT.
2. Study of biasing circuits of JFET/MOSFET
3. Measurement of pinch off voltage and plot transfer characteristics and drain characteristics of JFET.
4. Plotting of gain frequency response of RC coupled amplifier.
5. Study of Class A,B power amplifier
6. Study of integrator and differentiator circuits using OPAMP
7. Study and calculation of phase-shift of RC phase shift oscillator
8. Calculation of rise time , tilt and low cut off frequency by square wave testing of amplifier

SIGNAL ANALYSIS & SYNTHESIS LAB: (0-0-3)

List of experiments (Any 8 of the following)

1. Waveform synthesis (generation of square, triangular and sine waves) using shifted functions.
2. Study of DC transients in RL, RC and RLC circuits.
3. Measurement of transform impedance.
4. Verification of Network Theorems.
5. Network functions and pole zero plots
6. Realization of an oscillator by changing (low pass) network elements.
7. Measurement of two port parameters.
8. Measurement of transmission parameters.
9. Synthesis of RL and RC two port networks.
10. Synthesis of RLC two port networks.

SIMULATION LAB I: (0-0-3)

Using PSPICE/MULTISIM Simulation of

1. Rectifier and Filter Circuits.
2. Biasing circuits for BJT / JFET.
3. Common Emitter/ Common Source RC Coupled Amplifier circuits.
4. Different application circuits using 555 Timer IC.
5. Oscillator Circuits using BJT/OP-AMP
6. Voltage Regulator circuits using Discrete Components / IC.
7. Multivibrator Circuits.
8. Comparator Circuits using OP-AMP
9. Modulation Circuits.
10. Demodulation Circuits

(EL15-020) ELECTRICAL MACHINES LAB-I (0-0-3)

1. Open circuit and short circuit on single phase transformer
2. Parallel operation of two single phase transformer and load sharing
3. Back –to-back test of Single phase transformer
4. Load characteristics of DC shunt/compound generator
5. Load characteristics of DC series Motor
6. Swinburne test and brake test of DC shunt machine

4TH SEMESTER

MATHEMATICS - IV

Complex Analysis, and Probability and Statistics) (3-1-0)

Module 1: (10 Lectures)
Complex Numbers, Complex Plane, Polar Form of Complex Numbers, Powers and Roots Derivative, Analytic Function, Cauchy-Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric and Hyperbolic Functions, Logarithm, General Power; Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions

Module 2: (10 Lectures)
Sequences, Series, Convergence Tests, Power Series, Functions Given by Power Series, Taylor and Maclaurin Series, Laurent Series, Singularities and Zeros, Infinity, Residue Integration Method, Residue Integration of Real Integrals; Geometry of Analytic Functions: Conformal Mapping, Linear Fractional Transformations, Special Linear Fractional Transformations, Conformal Mapping by Other Functions.

Module 3: (10 Lectures)
Random Variables, Probability Distributions, Mean and Variance of a Distribution, Binomial. Poisson, and Hypergeometric Distributions, Normal Distribution

Module 4: (10 Lectures)
Introduction. Random Sampling, Point Estimation of Parameters, Confidence Intervals, Testing Hypotheses, Decisions, Regression, Fitting Straight Lines, Correlation.

Text Book:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: 13, 14, 15(except 15.5), 16, 17(except 17.5), 24(24.5-24.8), 25(25.1-25.4, 25.9)

Reference Books:

1) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill
2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis

K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

DIGITAL ELECTRONICS CIRCUITS: (3-1-0)

Module-I **(12 Hours)**

Binary addition and subtraction using 2's complements and 1's complements, Binary codes, BCD codes, Gray codes, Excess-3 code, ASCII Character Code

Gate level Minimization: Boolean functions, Canonical & standard form; min terms & max term, Digital Logic Gates for Multiple inputs. The Map Method, K Map for two, three, four, five input variables, Product of Sum (POS), Sum of product (SOP) simplification, Don't care conditions. NAND & NOR Implementation, AND-OR invert, OR-AND invert implementation, Ex-OR Function

Module-II **(8 Hours)**

Combinational Logic: Combinational Circuits, Analysis & Design of Binary Half Adder & Full Adder circuit, Half and Full-subtractor circuit, Binary Multiplier, Magnitude comparator, Decoders, Encoders, Multiplexers, Error detection& correction: Parity Generator and Checker Circuit

Module-III **(12 Hours)**

Synchronous Sequential Logic: Sequential Circuit, Latches, Flip-flop (S-R, J-K, D, T, M/S), Analysis of Clocked Sequential circuits, State Reduction & Assignment, Design procedure.

Register &Counters: Shift Register, Synchronous Counter, Modulo-n Counters, Up-Down Counter, Asynchronous Counter, Ripple Counters, Ring Counters

Module-IV **(8 Hours)**

Memory & Programmable Logic: Read only Memory (ROM), Random Access Memory (RAM), Memory Decoding, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Sequential Programmable Devices.

Register Transfer Levels: Register transfer Level (RTL) notation, Algorithmic State machine, Design Example. Digital Integrated logic Circuits: RTL, DTL, TTL, ECL, MOS & C-MOS Logic circuits

Text books:

1. Digital Design, 4th edition by M. Morris Mano, M. D. Ciletti, Pearson Education.

Reference Books:

2. Digital Fundamentals – Floyd & Jain, Pearson education
3. Switching Theory & Digital Electronics – V. K. Jain, Khanna Publishers.
4. Digital Principles & Applications – Malvino, Leach & Saha, 6th Edition, Tata Mc Graw Hill

ANALOGUE COMMUNICATION TECHNIQUES: (3-1-0) – Credit: 4

Module-I **(12 Hours)**

Spectral Analysis: Fourier Series: The Sampling Function, The Response of a linear System, Normalized Power in a Fourier expansion, Impulse Response, Power Spectral Density, Effect of Transfer Function on Power Spectral Density, The Fourier Transform, Physical Appreciation of the Fourier Transform, Transform of some useful functions, Scaling, Time-shifting and Frequency shifting properties, Convolution, Parseval's Theorem, Correlation between waveforms, Auto-and cross correlation, Expansion in Orthogonal Functions, Correspondence between signals and Vectors, Distinguishability of Signals.

Module-II **(14 Hours)**

Amplitude Modulation Systems: A Method of frequency translation, Recovery of base band Signal, Amplitude Modulation, Spectrum of AM Signal, The Balanced Modulator, The Square law Demodulator, DSB-SC, SSBSC, and VSB, Their Methods of Generation and Demodulation, Carrier Acquisition, Phase-locked Loop (PLL), Frequency Division Multiplexing.

Frequency Modulation Systems: Concept of Instantaneous Frequency, Generalized concept of Angle Modulation, Frequency modulation, Frequency Deviation, Spectrum of FM Signal with Sinusoidal Modulation, Bandwidth of FM Signal Narrowband and wideband FM, Bandwidth required for a Gaussian Modulated WBFM Signal, Generation of FM Signal, FM Demodulator, PLL, Pre-emphasis and De-emphasis Filters.

Module-III **(12 Hours)**

Mathematical Representation of Noise: Sources and Types of Noise, Frequency Domain Representation of Noise, Power Spectral Density, Spectral Components of Noise, Response of a Narrow band filter to noise, Effect of a Filter on the Power spectral density of noise, Superposition of Noise, Mixing involving noise, Linear Filtering, Noise Bandwidth, Quadrature Components of noise.

Noise in AM Systems: The AM Receiver, Super heterodyne Principle, Calculation of Signal Power and Noise Power in SSB-SC, DSB-SC and DSB, Figure of Merit, Square law Demodulation, The Envelope Demodulation, Threshold

Module-IV **(8 Hours)**

Noise in FM System: Mathematical Representation of the operation of the limiter, Discriminator, Calculation of output SNR, comparison of FM and AM, SNR improvement using pre-emphasis, Multiplexing, Threshold in frequency modulation

Text Book:

1. Principles of Communication Systems by Taub & Schilling,2nd Edition.Tata Mc Graw Hill. Selected portion from Chapter 1, 3, 4, 8, 9 & 10

References Books:

1. Modern digital and analog communication system, by B. P. Lathi, 3rd Edition, Oxford University Press.
2. Digital and analog communication systems, by L.W. Couch, 6th Edition, Pearson Education, Pvt. Ltd.
3. Communication Systems by Simon Haykin, 4th Edition, John Wiley and Sons Inc.

ANALOG ELECTRONIC CIRCUITS–II (3-1-0)

Module 1 **(10 Hours)**

Review of Selected Topics in Electronic Circuits, Active Filters: First & Second order low pass/high pass, band pass, band reject, and all pass filters. Universal active filter design, Comparators, Sawtooth wave generator using OP Amps, Waveform Conversion, Instrumentation Amplifier. Wideband amplifiers: Frequency response, Transient response of transistor stage, shunt compensation of a transistor stage in cascade, Rise time of cascaded compensated stages, low frequency compensation. Tuned Amplifiers: Single tuned, Double tuned, Staggered tuned.

Module 2 **(8 Hours)**

Bistable Multivibrator: Stable States of a binary, Fixed Biased and Self-biased Transistor binary, Commutating Capacitors, Symmetrical and Unsymmetrical triggering, Direct connected binary, Schmitt trigger Circuit, Emitter coupled Binary. The Monostable Multivibrator: Collector coupled Monostable Multi, Waveforms, Emitter-coupled Monostable Multi, triggering of Monostable Multi. Astable-Multivibrator: Emitter Coupled, Collector Coupled, Waveforms.

Module 3 **(10 Hours)**

Negative resistance devices and Negative Resistance Switching Circuits: Tunnel diode, UJT operation and characteristics, Application of UJT to generate Sawtooth waveform, Tunnel diode monostable, astable, bistable and comparator circuits.

Module 4 **(10 Hours)**

Analysis of Voltage time base generator, Current time base generator, Pulse Transformer and Blocking Oscillator, IC 555 Timer Circuit and Applications, Voltage Controlled Oscillator, Phase Locked Loop.

Text Book:

1. Pulse, Digital and Switching Waveforms – Jacob Millman, Herbert Taub, M. Prakash Rao, 2nd Ed, The McGraw-Hill Companies (Selected portions from Chapters 4, 5, 10, 11, 12, 13, 14 and 15).

2. Electronic Principles- A.Malvino, D.Bates, 7thEd, The McGraw-Hill Companies. (Selected Portions from Chapters 21, 22, 23 for Module 1 and 4 only)

Reference Book:

1. OP-Amps and Linear Integrated Circuits-RamakantA.Gayakwad (PHI Learning Pvt.Ltd.)
2. Pulse, Switching and Digital Circuits-D.A. Bell (Oxford Publishing).
3. Pulse and Digital Circuits by A.Anand Kumar, PHI Learning Pvt. Ltd.

BHU-1301 Organisational Behaviour (3-1-0)

Module-1(8 hours)

OB: Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager

LEARNING: Nature of learning, How learning occurs, Learning & OB

Case Study Analysis

Module-2 (10 hours)

PERSONALITY: Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB

PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OB

MOTIVATION: Nature & Importance, Herzberg's Two Factor theory, Maslow's Need Hierarchy theory, Alderfer's ERG theory

Case Study Analysis

Module-3 (10 hours)

COMMUNICATION: Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness

GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building

LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, Contingency Theory, Leadership & Followership, How to be an Effective Leader

CONFLICT: Nature of Conflict & Conflict Resolution

TRANSACTIONALANALYSIS: An Introduction to Transactional Analysis

Case Study Analysis

Module-4 (12 hours)

ORGANISATIONAL CULTURE: Meaning & Definition, Culture &Organisational Effectiveness

HUMAN RESOURCE MANAGEMENT: Introduction to HRM, Selection,Orientation,Training& Development, Performance Appraisal, Incentives

ORGANISATIONAL CHANGE: Importance of Change, Planned Change & OB Techniques

INTERNATIONAL OB: An Introduction to Individual & Interpersonal Behaviour in Global Perspectives

Case Study Analysis

Text Books/References:

[1] Stephen P. Robbins, Organisational Behaviour, Printice hall of India, New Delhi,2000.

[2] K. Aswathappa, Organisational Behaviour, Himalaya Publishing House, Bombay, 1997.

[3] S. S. Khanka, "Organisational Behaviour", S. Chand Publication, Revised edition 2009.

Course Objectives:

1. To predict, understand and control the human behaviour in an organisation
2. To develop interpersonal relation in organisation
3. To maintain cordial industrial relation
4. To manage human resources efficiently in an organisation

Course Outcomes:

1. Students will be able to maintain the interpersonal and industrial relation when they will join into one organization.
2. Able to develop effective leadership quality.
3. Able to apply appropriate motivational techniques in accordance to the nature of the individual employee.
4. Able to manage human resources efficiently in an organisation.

DIGITAL ELECTRONICS LAB: (0-0-3)

List of experiments

1. Digital logic gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert& Buffer gates, use of Universal NAND Gate.
2. Gate level minimization: Two level & multi-level implementation of Boolean function.
3. Combinational circuits: design, construct& test: adder& substractor, code converter, gray code to binary and 7 segment displays.
4. Design, Implement & test a given design example with (i)NAND Gate only,(ii)XOR Gate only
5. Design with multiplexers & de multiplexers.
6. Flip flop: Construct, test& investigate operation of SR, D, J-K flip flop.
7. Shift register: Investigate the operation of all types of shift register with parallel load Design.
8. Counters: design, construct& test various ripple & synchronous counters-decimal counter, Binary counter with parallel load.
9. Memory unit: Investigate the behavior of RAM unit & its storage capacity-16X4 RAM: Testing, simulating, memory expansion.
10. Clock Pulse generator design, implement& test.
11. Parallel adder & accumulator: -: design, implement& test.
12. Binary multiplier: design & construct a circuit that multiplier 4 bit unsigned numbers to produce an 8 bit product.

ANALOG COMMUNICATION TECHNIQUE LABORATORY (0-0-3)

List of experiments

1. Write MATLAB code to find convolution, autocorrelation, cross- correlation and power spectral density of different functions.
2. Write MATLAB program for generation and detection of
i) DSB-SC
ii) SSB-SC.
3. Study of balanced modulator and detector of AM signal (using H/W Kit- C020).
4. To study amplitude modulated waveforms for different modulation depths and measure the value of modulation index (using H/W Kit- C09A)
5. To study the demodulation process and measure detection efficiency (using H/W Kit- C009).
6. To generate and detect frequency modulation (FM) signals using MATLAB.
7. To detect FM signal using Foster-Seely discriminator (using H/W Kit- C15C).
8. Study of PLL using MATLAB code and detection of FM signal (using H/W Kit- C15B).
9. Write MATLAB code to generate and detect PM.
10. Study of Voltage Controlled Oscillator (using H/W Kit- C25A)

DESIGN AND TESTING LAB (0-0-3)

List of experiments

Design, Construction and Testing of

1. Rectifier Circuits with Filter Circuits
2. Logic Gates Using Discrete Components
3. Sinusoidal Oscillator Circuits
4. Biasing Circuits
5. Voltage Regulator Circuits
6. Voltage Amplifier Circuits
7. Sample and Hold Circuits Using OP-AMP
8. Power Amplifier Circuits
9. Multivibrator Circuits
10. Time base Generator Circuits
11. Active Filter Circuits
12. Relaxation Oscillator Circuits

SIMULATION LAB II: (0-0-3)

List of experiments

VHDL / Verilog HDL Simulation (Xilinx ISE Tool) of

1. Different Adder Circuits.
2. Different Subtractor Circuits.
3. Multiplexer Circuits.
4. Encoder Circuits
5. Decoder Circuits.
6. Different Flip-Flops Circuits.
7. Memory Circuits.
8. Different Counter Circuits.
9. Register Circuits.
10. ALU circuit.

5TH SEMESTER
DIGITAL COMMUNICATION TECHNIQUES (3-1-0)

Module-I **(8 Hours)**

Sampling Theorem, Low Pass Signal, Band Pass Signal, Signal Reconstruction, Practical Difficulties, The Treachery of Aliasing, The Anti-aliasing Filter, Application of Sampling Theorem, PAM, PWM and PPM Signal Generation and Detection.

Module-II **(12 Hours)**

Pulse Code Modulation: Quantization of Signals, Uniform and Non-Uniform Quantization, The Compander, The encoder, Transmission Bandwidth and output SNR, Digital multiplexer, Synchronizing and Signaling, Differential PCM, Delta Modulation, Adaptive Delta Modulation, Output SNR, Comparison with PCM. Noise in PCM and DM: Calculation of Quantization Noise Power, Output Signal Power, and the Thermal Noise Power, Output SNR of PCM using different modulation techniques. Output SNR of DM.

Module-III **(12 Hours)**

Principles of Digital Data Transmission:

A Digital Communication System, Line Coding-Various line codes, Polar Signaling, ON-OFF Signaling,

Bipolar Signaling, Pulse Shaping: Nyquist Criterion for zero ISI, Scrambling, Regenerative Repeater-Preamplifier, Equalizer, Eye diagram, Timing Extraction, Timing Jitter, A Base-band Signal Receiver, Peak Signal to RMS Noise output voltage ratio, The Optimum Filter, White Noise, The Matched Filter-Probability of Error of the Matched Filter, Coherent Reception.

Module-IV **(10 Hours)**

Digital Modulation Technique:

Generation, Transmission, Reception, Spectrum and Geometrical Representation in the signal space of BPSK, BFSK, Differentially- Encoded PSK, QPSK, Minimum Shifting Keying (MSK), M-ary PSK, M-ary FSK, Use of Signal Space to calculate probability of Error for BPSK and BFSK.

Text Books:

1. Principles of Communication Systems by Taub & Schiling, 2nd Edition, Tata Mc Graw Hill. Selected portion from Chapter 5, 6, 11, and 12.
2. Modern Digital and Analogue Communication Systems by B.P.Lathi, 3rd Edition, Oxford University Press. Selected Portion from Chapter 6, 7, 13, and 14.

Reference Books:

1. Communication System, Analog and Digital, R.P.Singh & S.D. Sapre, TMH.
2. Digital and Analogue Communication System, Leon W.Couch-II, 6th Edition, Pearson.
3. Communication System by Simon Haykin, 4th Edition, John Wiley & Sons, Inc.

DIGITAL SIGNAL PROCESSING (3-1-0)

Module-I **(10 Hours)**

Discrete time signals and systems, The Convolution Sum and its properties, Difference Equation, Implementation of DT System, Correlation, LTI systems as Frequency-Selective Filters, Inverse Systems and Deconvolution.

Module-II **(10 Hours)**

Analysis of LTI system in z-Domain, One-sided z-Transform, The DFT as a linear transformation, Circular Convolution, Circular Correlation, Linear Filtering Methods Based on the DFT, The Discrete Cosine Transform(Brief Idea only).

Module-III **(10 Hours)**

Fast Fourier Transform Algorithms: Radix –2 FFT algorithm – Decimation – in Time (DIT) and Decimation – in Frequency (DIF) algorithm, Applications of FFT Algorithms, The Chirp-z Transform Algorithm.

Module-IV **(10 Hours)**

Structures for FIR and IIR Systems - Direct and Cascaded form, Design of Digital Filters: Causality and its Implications, Design of Linear Phase FIR filters using different windows, Design of IIR Filters – Impulse Invariance Method and Bilinear transformation method.

Text Books:

1. Digital Signal Processing – Principles, Algorithms and Applications - J.G.Proakis and D.G.Manolakis,4th Edition, PHI Learning Pvt. Ltd.
2. Digital Signal Processing - S.Salivahanan, A.Vallavaraj, C. Gnanapriya, 2nd Edition The McGraw-Hill.

Reference Books:

1. Digital Signal Processing, Tarun Kumar Rawat, 1st Edition, 2015 Oxford university press.
2. Introduction to Digital Signal Processing –J.R.Johnson, PHI learning Pvt. Ltd.
3. Discrete Time Signal Processing- A.V. Oppenheim and Schafer, PHI Learning Pvt.
4. Digital Signal Processing: A computer based Approach - Sanjit K. Mitra, The McGraw-Hill.

ELECTROMAGNETIC FIELD THEORY (3-1-0)

Module-I (12 Hours)

The Co-ordinate Systems, Rectangular, Cylindrical, and Spherical Co-ordinate System. Co-ordinate transformation. Gradient of a Scalar field, Divergence of a vector field and curl of a vector field. Their Physical interpretation. The Laplacian operator. Divergence Theorem, Stokes Theorem. Useful vector identifies.

Electrostatics: The experimental law of Coulomb, Electric field intensity. Field due to a line charge, Sheet charge and continuous volume charge distribution. Electric Flux and flux density; Gauss's law. Application of Gauss's law. Energy and Potential. The Potential Gradient. The Electric dipole. The Equipotential surfaces. Energy stored in an electrostatic field. Boundary conditions. Capacitors and Capacitances. Poisson's and Laplace's equations. Solutions of simple boundary value problems. Method of Images.

Module-II (10 Hours)

Steady Electric Currents: Current densities, Resistances of a Conductor; The equation of continuity. Joules law. Boundary conditions for Current densities. The EMF.

Magnetostatics: The Biot-Savart's law. Amperes Force law. Torque exerted on a current carrying loop by a magnetic field. Gauss's law for magnetic fields. Magnetic vector potential. Magnetic Field Intensity and Ampere's Circuital law. Boundary conditions. Magnetic Materials. Energy in magnetic field. Magnetic circuits.

Module-III (12 Hours)

Faraday's law of Induction; Self and Mutual Induction. Maxwell's Equations from Ampere's and Gauss's Laws. Maxwell's Equations in Differential and Integral forms; Equation of continuity. Concept of Displacement Current. Electromagnetic Boundary Conditions, Poynting's Theorem, Time-Harmonic EM Fields.

Plane Wave Propagation: Helmholtz wave equation. Plane wave solution. Plane Wave Propagation in lossless and lossy dielectric medium and conducting medium. Plane wave in good conductor, Surface resistance, depth of penetration. Polarization of EM wave- Linear, Circular and Elliptical polarization. Normal and Oblique incidence of linearly polarized wave at the plane boundry of a perfect conductor, Dielectric-Dielectric Interface. Reflection and Transmission Co-efficient for parallel and perpendicular polarization, Brewster angle.

Module-IV (8 Hours)

Radio Wave Propagation: Modes of propagation, Structure of Troposphere, Tropospheric Scattering, Ionosphere, Ionospheric Layers - D, E, F1, F2, regions. Sky wave propagation - propagation of radio waves through Ionosphere, Effect of earth's magnetic field, Virtual height, Skip Distance, MUF, Critical frequency, Space wave propagation.

Text Books:

1. Elements of Electromagnetic by Mathew N.O.Sadiku, Publisher Oxford University Press
2. Electromagnetic Waves and Radiating Systems E.C.Jordan & K.G.Balmin

Reference Books:

1. Electromagnetic Fields Theory, Fundamental by B.S.Guru & Huseyn R. Hiziroglu. Publication: Thomson Asia Pvt.Ltd. Singapore
2. Electromagnetic, By David K.Cheng, 2nd Edition, Publisher :Pearson Education.

MICROPROCESSORS (3-1-0)

Module-1 **(10 Hours)**

Introduction to Microprocessor, Intel 8085 Microprocessor: Architecture, pins & signals, Register organization, Timing &control unit, Instruction Timing & Execution, Instruction set of 8085, Memory & I/O Addressing, Assembly language programming using 8085 instructions set.

Module-2 **(8 Hours)**

Interfacing EPROM &RAM Memories: 2764 and 6264, Stack & Subroutines, Restart, Conditional Call and Return Instructions, Advanced Subroutine Concepts, 8085 Interrupts, Vectored Interrupts, Restart as Software Instructions.

Module-3 **(10 Hours)**

Programmable peripheral Interface: 8255, Programmable DMA Controller: 8257, Programmable Interrupt Controller: 8259, Programmable Interval Timer: 8253.

Module-4 **(12 Hours)**

Intel 8086: introduction, pins & signal description, Architecture, Bus timing, minimum mode 8086, and maximum mode 8086, Instruction formats, Addressing modes, Instruction set: data transfer instruction,arithmetic and logic instruction, program control instructions, Assembly language programming with 8086, 8086 interrupts, Parameter passing.

Intel 80386 and 80486: Architecture, Register Organization, Protected mode, Paging, Virtual mode.Salient features of Pentium Processor.

Text books:

1. Microprocessor Architecture, programming and applications with the 8085 by R.S. Gaonkar, Penram International, India.

2. Microprocessors and Microcontrollers by N.Senthil Kumar, M.Saravanan, and S.Jeevananthan, Oxford University Press.

Reference Books:

1. Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing by A.K.Ray and K.M.Bhurchandi, TMH
2. Intel Microprocessors: Architecture, Programming and Interfacing by Barry B.Bray,PHI

VLSI DESIGN (3-1-0)

Module I **(08 Hours)**

Introduction: Design Hierarchy, Layers of Abstraction, Integration Density and Moore's Law, VLSI Design Styles, Packaging Styles, Design Automation Principles; Fabrication Technology: Basic Steps of Fabrication, Bipolar, CMOS and Bi-CMOS Fabrication Processes, Layout Design Rules.

Module II **(08 Hours)**

MOS and Bi-CMOS Characteristics and Circuits: MOS Transistor Characteristics, MOS Switch and Inverter, Bi-CMOS Inverter, Latch-Up in CMOS Inverter, Super-Buffers, Propagation Delay Models, Switching Delay in Logic Circuits, CMOS Analog Amplifier.

Module III **(12 Hours)**

Logic Design: Switch Logic, Gate Restoring Logic, Various Logic Families and Logic Gates, PLA; Dynamic Circuits: Basic Concept, Noise Considerations, Charge Sharing, Cascading Dynamic Gates, Domino Logic, Np-CMOS Logic, Clocking Schemes; Sequential Circuits: Basic Regenerative Circuits, Bistable Circuit Elements, CMOS SR Latch, Clocked Latch and Flip-Flops; Low-Power Circuits: Low-Power Design through Voltage Scaling, Estimation and Optimization of Switching Activity, Reduction of Switched Capacitance, Adiabatic Logic Circuits.

Module IV **(12 Hours)**

Subsystem Design: Design of Arithmetic Building Blocks Like Adders, Multipliers, Shifters, Area-Speed-Power Tradeoff; Semiconductor Memories: SRAM, DRAM, Non-Volatile Memories; Bipolar ECL Inverter: Features of ECL Gate, Robustness and Noise Immunity, Logic Design in ECL, Single-Ended and Differential ECL Gates; Testability of VLSI: Fault Models, Scan-Based Techniques, BIST, Test Vector Generation; Physical Design: Brief Ideas on Partitioning, Placement, Routing and Compaction.

Text Books:

1. J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, Prentice Hall of India.
2. Kang and Leblebici, CMOS Digital Integrated Circuits Analysis and Design, McGraw Hill.

Reference Books:

1. N. Weste and D. Harris, CMOS VLSI Design: A Circuits and Systems Perspective, Pearson Education India.
2. D. A. Hodges, H. G. Jackson, R. Saleh, Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology, McGraw Hill.
3. Douglas A.Pucknell, Kamran Eshiraghian, Basic VLSI Design, Prentice Hall of India.

DIGITAL COMMUNICATION LABORATORY (0-0-3)

List of Experiments

1. AD and DA converters-Linearity.
2. 2 Level to N-Level converter.
3. Delta Modulation and Adaptive Delta Modulation.
4. Generation of PSK, DPSK and QPSK signal.
5. Generation of FSK and MSK signal.
6. Generation of ASK and QAM signal.
7. QPSK Demodulation.
8. Design of a PN sequence Generator.
9. TDM(MATLAB Simulation).
10. Performance of any digital mod/demod. scheme in the presence of noise(MATLAB simulation).

DIGITAL SIGNAL PROCESSING LAB (0-0-3)

List of Experiments

1. Different types of Signal generation using MATLAB both continuous and discrete)
2. Linear Convolution of sequences (Without using the inbuilt function (conv) available in MATLAB.)
3. Circular Convolution of two Sequences Comparison of result with the result obtained from linear convolution.
4. i) Finding Auto correlation of a sequence.
   ii) Finding cross correlation of 2 sequences.
   iii) Finding power spectral density of a sequence.

5. Finding the convolution of periodic sequence using DFT and IDFT
6. Implementation of FFT (Fast Fourier Transform) algorithm
   i) Decimation in Time (DIT)
   ii) Decimation in Frequency (DIF)
7. Design of FIR filter (low pass, high pass, band pass). Using windowing technique (harming window,hamming, window rectangular window, Kaiser Window.

8. Design of IIR filter.(Design of Butter worth Filter Design of Chebyshev filter)
9. Convolution of long duration sequences using overlap add, overlap save meter.
10. Working with a DSP processor. (Fixed point-TMS320C-5X/Floating point) series.
    i) Implement convolution (Linear and circular convolution)
    ii) FIR & IIR implementation. With

Lab. Reference:

Digital Signal Processing a hands – on approach by Schucer C, Mohesh Chgave (TMH)

MICROPROCESSOR LAB (0-0-3)

List of Experiments

1. Verify some instructions from instruction sets.
2. Addition, Subtraction, Multiplication, Division of two numbers.
3. Binary to Gray Code Conversion.
4. Hexadecimal to decimal conversion.
5. Generation of time delay.
6. Smallest/Largest number from a given data array.
7. Square of a number by adding successive odd integers.
8. Copy data from one memory area to other.
9. Generate square wave on all the ports of 8255.
10. Generate sine wave, triangular wave, and saw tooth wave using DAC.
11. Interface Stepper Motor .
12. Study of 8253, 8279, 8259.

VLSI DESIGN LAB (0-0-3)

The following experiments need to be carried out using Digital and Analog Design environments and HDL Simulation Tools

1. Study of V-I Characteristics of
    a) nMOS Transistor
    b) pMOS Transistor
    c) CMOS Transistor

2. Study of Transfer Characteristics of Resistive Load Inverter
    a) Pseudo nMOS Load Inverter
    b) nMOS Load Inverter
    c) Depletion Load Inverter
    d) CMOS Inverter
3. Study of Transient Characteristics of
    e) Resistive Load Inverter
    f) Pseudo nMOS Load Inverter
    g) nMOS Load Inverter
    h) Depletion Load Inverter
    i) CMOS Inverter
4. Study of Transient Characteristics of the following Logic Circuits using Gate Logic / Switch Logic.
    a. Two input NAND/AND gate
    b. Two input NOR/OR gate
    c. Two input XNOR/XOR gate
5. Study of Transient Characteristics of the following Logic Circuits using Dynamic Logic.
    a. Two input NAND/AND gate
    b. Two input NOR/OR gate
    c. Two input XNOR/XOR gate
6. Construction of Stick diagram of
    a. Two input NAND/AND gate
    b. Two input NOR/OR gate
    c. Two input XNOR/XOR gat
7. 6. Construction of Mask Layout of
    a. Two input NAND/AND gate
    b. Two input NOR/OR gate
    c. Two input XNOR/XOR gat
8. Design, Simulation and FPGA Implementation of
    a) Multiplier Circuit
    b) Divider Circuit
    c) ALU Circuit
    d) Memory Circuit

6TH SEMESTER

ELECTRONICS MEASUREMENT & MEASURING INSTRUMENTS (3-1-0)

Module-I **(12 Hours)**

Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement.Bridge Measurement: DC bridges- wheat stone bridge, AC bridges – Kelvin, Hay, Maxwell, Schering and Wien bridges, Wagner ground Connection.Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter.

Module-II **(12 Hours)**

Oscilloscopes: Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Delay lines, Probes and Transducers, Specification of an Oscilloscope. Oscilloscope measurement Techniques, Special Oscilloscopes – Storage Oscilloscope, Sampling Oscilloscope,Signal Generators: Sine wave generator, Frequency – Synthesized Signal Generator, Sweep frequency Generator. Pulse and square wave generators. Function Generators.

Module-III **(10 Hours)**

Signal Analysis: Wave Analyzer, Spectrum Analyzer. Frequency Counters: Simple Frequency Counter; Measurement errors; extending frequency range of counters Transducers: Types, Strain Gages, Displacement Transducers.

Module-IV **(6 Hours)**

Digital Data Acquisition System: Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. An Introduction to Computer-Controlled Test Systems.IEEE-488 GPIB Bus

Text Books:

1. Modern Electronics Instrumentation & Measurement Techniques, by Albert D.Helstrick and William D.Cooper, Pearson Education. Selected portion from Ch.1, 5-13.
2. Elements of Electronics Instrumentation and Measurement-3rd Edition by Joshph J.Carr.Pearson Education. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25.

Reference Books :

1. Electronics Instruments and Instrumentation Technology – Anand, PHI
2. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990.

MICROWAVE ENGINEERING (3-1-0)

Module-I (14 Hours)

High Frequency Transmission line and Wave guides: The Lumped-Element Circuit model for a Transmission line. Wave propagation. The lossless line. Field Analysis of Co-ax Transmission Lines. R, L, C, G parameters of Co-axial & Two wire Transmission lines, Terminated lossless transmission line, Low loss line, The Smith Chart. Solution of Transmission line problems using Smith chart. Single Stub and Double Stub matching.

Waveguides: Rectangular waveguides, Field solution for TE and TM modes, Design of Rectangular waveguides to support Dominant TE_{10} only.

Module-II (10 Hours)

TEM mode in Co-axial line. Cylindrical waveguides- Dominant mode. Design of cylindrical waveguides to support dominant TE_{11} mode.

Microwave Resonator: Rectangular waveguides Cavities, Resonant frequencies and of cavity supporting. Dominant mode only. Excitation of waveguides and resonators (in principle only).

Waveguides Components: Power divider and Directional Couplers: Basic properties.

The T-Junction power divider, Waveguide-Directional Couplers.

Fixed and Precision variable Attenuator, Isolator, Circulator (Principle of Operation only).

Module-III (10 Hours)

Microwave Sources: Reflex Klystron: Velocity Modulation, Power output and frequency versus Reflector voltage Electronic Admittance. Multi Cavity Magnetron: Principle of operation, Rotating field, π-mode of operation, Frequency of oscillation. The ordinary type (O-type) travelling wave tube- Construction features, principle of operation as an amplifier, Gunn oscillator (principle).

Module-IV (6 Hours)

Microwave Propagation: Line of sight propagation. Attenuation of microwaves by Atmospheric gases, water vapours & precipitates.

Text Books:

1. Microwave Engineering by D.M.Pozar, 2nd Edition, John Willy & Sons. Selected portions from Chapters 2,3,4,6,7&9.

2. Microwave Devices and Circuits, 3rd Edition, Sammuel Y, Liao, Perason.

Reference Book:

1. Principles of Microwave Engineering by Reich, Oudong and Others.

Digital Image Processing [3-1-0]

Module I **10 Hours**

Digital Image Fundamentals:

Components of image processing system, image fundamentals, image sampling and quantization, basic relationships between pixels, color image fundamentals – RGB, YC $_b$Cr, HSI models, 2D-transforms – DFT, DCT, KLT, slant transform, Hough transform, Properties of transforms and applications, Fundamentals on wavelet transform.

Module II **10 Hours**

Image Enhancement:

Enhancement in spatial domain: basic gray level transformations, histogram processing, smoothing and sharpening of spatial filters. Enhancement in frequency domain: Introduction to filtering in frequency domain, smoothing and sharpening of frequency domain filters.

Module III **8 Hours**

Image Restoration:

Degradation model, restoration in presence of noise only – spatial filtering, linear, position invariant degradations, estimating degradation functions, inverse filtering, Wiener filtering.

Module IV **12 Hours**

Image compression and segmentation:

Redundancy and compression models, Lossless coding – Run length coding, Huffman coding, vector quantization, JPEG, concepts of fractals , fractal image compression.

Edge detection, Boundary description, Morphological image processing, Region based segmentation – region growing, region merging and splitting.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, ‘Digital Image Processing', Pearson, Second Edition, 2004.
2. Anil K. Jain, ‘Fundamentals of Digital Image Processing', Pearson 2002.

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
2. William K. Pratt, ‘ Digital Image Processing' , John Wiley, New York, 2002

MICROCONTROLLER AND EMBEDDED SYSTEM (3-1-0)

Module-1 **(10 hours)**

Introduction, Microcontroller and Embedded Processor, Introduction to Embedded System, Embedded System vs. General computing systems, Application areas of Embedded systems, Elements of Embedded Systems, General purpose and ASIC processor, RISC vs. CISC processor/Controllers.

Module-2 **(10 hours)**

Introduction to 8051 assembly language programming, The Program Counter and ROM space in the 8051,Flag Bits and PSW Register, Register Banks and Stack, Loop and Jump instruction, Call instruction, Time delay ,I/O port programming, Addressing modes.

Module-3 **(10 hours)**

Unsigned addition and subtraction, Unsigned multiplication and division, Signed arithmetic operations, Logic instructions and programs, BCD and ASCII application programs, Single bit instruction programming, Programming Timers, Counter programming, Basics of serial communication, 8051 interrupt and programming.

Module-4 **(10 hours)**

Interfacing Stepper motor, DAC interfacing ,8051interfacing with external ROM, 8255 interfacing.

Text Books:

1. M.A.Mazidi,&J.G.Mazidi:The 8051 Microcontroller and Embedded Systems,Pearson Education,India.
2. SHIBU K.V: Introduction to Embedded Systems, Mc Graw Hill Education, New Delhi, India.

Reference Books:

1. Raj Kamal: Embedded Systems, Architecture, Programming and Design, Mc Graw Hill

INSTRUMENTATION LABORATORY (0-0-3)
List of experiments

1. Study of resistance & temp -voltage characteristics of Thermistor.
2. Study of resistance & temp -voltage characteristics of RTD.
3. Measurement of temperature-voltage characteristics of Thermocouple.
4. Determination of characteristics between strain applied & the voltage output.
5. Study of the characteristics of LVDT and plotting the displacement-voltage graph.
6. Plotting the characteristics between strain applied to a beam and the output voltage for a strain gauge.
7. Study of PID controller.
8. Study of Temperature control system.

MICROWAVE LAB (0-0-3)

List of experiments

1. Study of Microwave Components and Devices.
2. Reflex Klystron Characteristics: **(a).** Electronic Tuning Range
   (b). Mode Curves
   (c). Carrier Wave Operation
   (d). Square Wave Operation
3. Measurement of Frequency and Wavelength in a rectangular waveguide working on TE_{10} mode.
4. Measurement of VSWR and Reflection coefficient by standing wave method.
5. Measurement of Unknown impedance using Smith chart.
6. Measurement of attenuation of Fixed and Variable attenuator.
7. Measurement of Main Line and Auxiliary Line VSWR, Coupling Factor, Insertion Loss and Directivity of a Directional coupler.
8. Study of power division in E-plane and H-plane TEE.
9. Radiation pattern and Gain of Waveguide Horn antenna.
10. Design and Study of H-plane TEE (using CST/ HFSS).

MICROCONTROLLER LAB: (0-0-3)

List of Experiments

1. Introduction to Keil µvision integrated development environment (IDE).
2. Initialise data to register and memory using immediate, register, direct, indirect addressing mode.
3. Addition & Subtraction of 16-bit number.
4. Multiplication & Division of 16- bit number.
5. Generation of time delay.
6. Copy ten bytes of data from ROM space 400H to RAM space 30H.
7. ASCII to BCD conversion and BCD to ASCII conversion.
8. Program 8255 to get data from PA and send to both PB and PC.
9. Interface ADCs and DACs with 8051 microcontroller.
10. Interface LEDs on PA1 of 8051 microcontroller.
11. Interface 7- segment display with 8051 microcontroller.
12. Interface stepper motor with 8051 microcontroller.

DIGITAL IMAGE PROCESSING LABORATORY (0-0-3)
List of experiments

1. Study of digital image and image formats. Conversion of color image to gray image using MATLAB
2. Basic gray level transformation – Image Negative, Log transformation and Power law transformation.
3. To find the histogram of a gray scale image and its equivalent histogram equalized image.
4. Image smoothening – Mean and median filters along with its variant applied on noisy image.
5. Application of Laplacian, Sobel, Canny operator to determine the edge of an image.
6. Frequency domain filtering [Ideal low pass, Butterworth low pass, Gaussian low pass] on noisy image.
7. Filtering and compression of image in wavelet domain.
8. Morphological operations on gray scale image.
9. Color image processing – conversion of color image from RGB to HSI, CMY, YC_bC_r color space and vice versa.
10. Affine transformations [scaling, translation and shear] on gray scale image.

7TH SEMESTER

COMMUNICATION SYSTEM ENGINEERING -I (3-1-0)

Module I **(12 Hours)**

Elements of Optical Fiber Communication System, Basic Optical Laws and Definitions, Optical Fiber Modes and Configurations, Single Mode Fiber, Graded Index Fiber Structure, Attenuation and Distortion in optical Fibers.

Module II **(08 Hours)**

LED and LASER Diodes, PIN Photo Detector, Avalanche Photo Diode, Optical Fiber System Link Budget.

Module III **(12 Hours)**

Kepler's Law, Satellite Orbits, Spacing and Frequency Allocation, Look Angle, Orbital Perturbation, Satellite Launching, Earth Station, Satellite Subsystems, Satellite System Link Models, Link Equations.

Module IV **(08 Hours)**

Multiple Access, Direct Broadcast Satellite Services, Application of LEO, MEO and GEO Satellites.

Text Books:

1. Optical Fiber Communications by Gerd Keiser, 4th Edition, Mc Graw-Hill International Editions.
2. Satellite Communications by Timothy Pratt, Charles Bostian and Jeremy Allnutt, 2nd Edition, Wiley Student Edition.

CONTROL SYSTEMS - (3-1-0)

MODULE-I **(10 HOURS)**

Introduction: Basic concept of control systems, Open loop and closed loop systems, Difference between Open loop and closed loop systems, classifications.

Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula. Feedback theory: Types of feedback, effect of degenerative feedback on control system, Regenerative feedback.

MODULE-II **(10 HOURS)**

Time domain analysis: Standard test signals (step, ramp, parabolic and impulse signals), Time response of 1st order system to unit step and unit ramp inputs, time response of 2nd order system to unit step input, time response specification, steady state errors and error constants of different types of control systems, generalized error series method.

Concept of stability: Necessary condition of stability, Hurwitz stability criterion, Routh stability criterion, application of Routh stability criterion to linear feedback systems, relative stability.

Root locus techniques: construction, determination of stability from root locus, determination of roots from root locus, root contour.

MODULE-III **(10 HOURS)**

Frequency domain analysis: Introduction, Bode plot, determination of stability from Bode plot, polar plot, Nyquist stability criterion, application of Nyquist stability criterion to linear feedback systems.

Controllers: Introduction, proportional, derivative and integral, control actions, PD, PI, PID controllers and their applications to linear feedback control systems, Zeigler-Nichols method of tuning of PID controller for known dynamic model of the plant.

MODULE-IV **(10 HOURS)**

State variable analysis: concept and analysis of state and state variable of homogeneous systems, state model for linear continuous time invariant SISO systems.

Digital control systems: Advantages and disadvantages of digital control systems, representation of sampled process, Shannon's sampling theorem, signal reconstruction.

Z-transfer function: Types and properties of Z-transform, transfer function of ZOH, relation between s and Z-transfer function, Inverse Z-transfer function, pulse Z-transfer function of sampled data closed loop control system, solution of difference equation.

TEXT BOOKS

[2]. K. Ogata, "Modem Control Engineering", PHI Publisher.
[3]. I.J. Nagrath, M. Gopal, "Control Systems Engineering", New Age International Publishers.

REFERENCE BOOKS

[4]. J.J.Distefano, III, A.R.Stubberud, I.J.Williams, "Feedback and Control Systems", TMH Publisher.
[5]. K.Ogata, "Discrete Time Control System", Pearson Education Asia Publisher.

Computer Communication & Networking (3-1-0)

Module I (10 Hours)

Introduction – Data Communication, Networks, Internet, Intranet, Protocols, Network Models, Addressing.

Physical Layer – Signals, Analog, Digital, Analog vs Digital, Transmission impairment, Data Rate Limits, Performance, Transmission Modes. Synchronous TDM. Transmission Media – Guided and Unguided. Switching – Circuit-Switched Networks, Datagram networks, Virtual circuit networks, structure of switch. Concepts of DSL and ADSL.

Module II (10 Hours)

Data Link Layer – Introduction, Data Link Control & Protocol – Framing, Flow & Error Control, HDLC & PPP, Multiple Access – Random(CSMA), Controlled.

Wired LAN – LLC, MAC, Ethernet. Wireless LAN. Connecting Devices – Repeaters, Hubs, Bridges, Two & Three layer Switches, Routers, Gateways, Backbone networks, V-LAN

Module III (10 Hours)

Network Layer – Logical addressing, IPv4 Address, IPv6 Addresses. Network layer protocol – internetworking,IPv4, IPv6 Protocol& Packet format, IPv4 vs IPv6, Transition from IPv4 to IPv6. Address Resolution protocols, Routing Protocols.

Transport Layer – Process to process delivery, UCP, TCP Congestion Control & Quality of Service – Data traffic, Congestion, Congestion Control, QoS and Flow Characteristics.

Module IV (10 Hours)

Application Layer – DNS, Remote Logging (Telnet), SMTP, FTP, WWW, HTTP, SNMP, Multimedia.

Text Books:

1. Data Communicationsand Networking (B.A. Forouzan), McGrawhill.
2. Data and Computer Communications (W.Stallings), Pearson Education.

Reference Books:

1. Computer Networks and Internets (D.Comer), Prentice Hall.
2. Understanding Data Communications and Networks (W.Shay), PWS.

COMMUNICATION SYSTEMS LAB (0-0-3)

List of Experiments

1. Measurement of Radiation pattern of Horn Antenna in Microware frequency.
2. Measurement of unknown impedance and matching at Microware frequency
3. Study of Satellite Earth station and design of its Antenna to meet a given specification.
4. Study of a Satellite Transponder of given specification, channel allocations CDMA facilities etc.
5. Measurement of Refractive Index profile, Numerical aperture attenuation and dispersion in a Multimode optical fiber
6. Establishing and Testing an optical Fiber Communication link
7. Designing an optical fiber communication link to a given specification.
8. Simulating TDM and WDM.

8TH SEMESTER
COMMUNICATION SYSTEM ENGINEERING- II (3-1-0)

Module I **(10 Hours)**

An Introduction to Radar:- Basic Principles of Radar- Range to a Target, Maximum Unambiguous Range, Radar Waveforms, Simple Form of Radar Equation, Radar Block Diagram, Radar Frequencies, Applications and Limitations of Radar, CW and Frequency Modulation Radar:- Doppler Frequency Shift, CW Radar, FMCW Radar.

Module II **(10 Hours)**

MTI and Pulse Doppler Radar:- Introduction to Doppler and MTI Radar- MTI and Pulse Doppler Radar, Sweep-to-Sweep Subtraction and the Delay Line Canceller, MTI Radar Block Diagram, Pulse Doppler Radar- High prf Pulse Doppler Radar, Medium prf Pulse Doppler Radar, Low prf Pulse Doppler Radar, Tracking Radars:-Tracking with Radar- Types of Tracking Radar Systems, Angle Tracking, Monopulse Tracking- Amplitude Comparison Monopulse Radar, Phase Comparison Monopulse Radar, Conical Scan and Sequential Lobing- Sequential Lobing, Conical Scan Radar.

Module III **(10 Hours)**

Basic Television System and Scanning Principles:- Resolution, Aspect Ratio and Rectangular Scanning, Persistence of Vision and Flicker, Vertical Resolution, The Kell Factor, Horizontal Resolution and Video Bandwidth, Interlaced Scanning, Composite Video Signal and Television Standards:- Lines and Scanning, Blanking Signal, Horizontal Sync and Blanking Standards, Video Modulation and Vestigial Sideband Signals, Sound Modulation and Inter Carrier System, Standard Channel Characteristics, Television Broadcast Channels, Various TV Broadcasting Systems.

Module IV **(10 Hours)**

Television Transmission and Relay Systems:- Design Principle of TV Transmitters, Block Diagram of TV Transmitters, Broadcast Television Receivers: - Block Diagram of Broadcast TV receiver and functional requirements of different stages of a receiver, Colour Television Signals and Systems: - Mixing of Colours and Colour perception, Chromaticity Diagram, Colour TV Transmission and Reception Fundamentals. Introduction to CCTV, CATV, BIS, HDTV and Digital Television.

Text Books:

1. Introduction to Radar Systems by Merrill I. Skolnik, 3rd Edition, TMH Publications.
2. Television and Video Engineering by Arvind M. Dhake, 2nd Edition, TMH Publications.

Reference Books:

1. Closed Circuit Television by Joe Cieszynski, 2nd Edition, Newnes Publications.

ANTENNA ENGINEERING (3-1-0)

Module-I (12 Hours)

Antenna Definition, Principles of Radiation, Basic antenna parameters, Retarded Vector Magnetic Potential, Radiation field from Current element., Current Distribution on a thin Wire. Half wave dipole and Quarter wave monopole.

Two-element array. Principle of Pattern Multiplication. Linear Array. Broadside and end fire patterns, Balun.

Module-II (12 Hours)

Folded Dipole, Yagi Antenna. Frequency Independent Antenna. Log Periodic Dipole array,
Secondary Source and Aperture Antennas (Basics & applications).

Module-III (10 Hours)

Horn Antennas-Pyramidal & Sectoral Horn. Radiation Pattern and Gain of horn antenna.
Parabolic Reflector Antenna -Principle, analysis, Radiation Pattern and Gain.
Principles of Cassegrain Antenna.

Module-IV (08 Hours)

Microstrip Antenna – Basic Characteristics, Rectangular Patch, Radiation principle, Feeding Techniques, Cavity model.

Antenna Measurements – Radiation Pattern, Gain and Input Impedance.

Text Books:

1. Electromagnetic Wave and Radiating system by E. C. Jordan and K.G. Balmain, 2nd Edition, PHI
2. Antennas Theory – Analysis and Design by C. Balanis, 2nd Edition, John Willey & Sons

References Books:

1. Antenna Engineering by J. D. Krauss.
2. Antenna Engineering by W. L. Weeks.
3. Antennas and Wave Propagation by G. S. N. Raju, Pearson Education.
4. Antenna & Wave Propagation by R E. Collins.

LIST OF CORE ELECTIVES

WIRELSS COMMUNICATION (3-1-0)

UNIT-1

Wireless communication fundamentals: Fundamental terms of communication, General model for wireless digital communication link, bandwidth, types of signals, types of communications systems, wired versus wireless media, Types of wireless system, cellular systems, cellular networks, existing technologies, and evaluation of wireless systems, licensed and unlicensed bands for existing wireless systems.

Cellular theory: Introduction, cellular infrastructure, cellular systems components, antennas for cellular systems, operation of cellular systems, channel assignment, cellular interference, sectorization, mobile traffic calculation, spectrum efficiency of cellular systems, location management

(8 Hours)

UNIT-2

Wireless channels and modeling: Radio propagation over wireless channel, Radio communication cases, free Space propagation model, Ground wave propagation, Ionospheric propagation, Torospheric propagation, channel noises and losses, fading in land mobile systems, fading effects on signal and frequency components, shadowing, signal outages and fading margin

Wireless channel modeling: channel modeling, additive white Gaussian noise, representation of discrete channel by filter, stochastic radio channel modeling, flat fading channel modeling, wideband time dispersive channel modeling, Rayleigh fading model, Rician fading model, Nakagami fading model, comparison of Rayleigh, Rician and Nakagami models, Okumura hata path loss model

(8 Hours)

UNIT-3

WIRELESS COMMUNICATION TECHNIQUES:

source of coding techniques: analog to digital conversion, wireless multimedia communication, source coding stages, quantization techniques, pulse code modulation, delta modulation, modification to pulse code modulation, information sources and entropy, information source coding fundamentals, vocoders, source coding in frequency domain.

modulation techniques: Digital modulation and performance parameters, line coding or signaling, constant envelope modulation, variable envelope modulation schemes, differential modulation schemes, offset modulation schemes, modulation schemes and spectrum efficiency, transmission power, spread spectrum modulation, Pseduo – noise codes, properties and code generation, direct sequence spread spectrum system, frequency hopping spread spectrum – transmitter and receiver, time hopping spread spectrum, hybrid spread spectrum systems, multicarrier techniques, orthogonal frequency division multiplexing transmitter and receiver

zero intersymbol interference, diversity, estimation, and equalization: Zero intersymbol interference communication techniques, detection strategies, matched filter, diversity combining techniques, introduction to multiple input multi output systems, channel estimation techniques, equalization techniques, least square and least mean squares algorithms

Multiplexing and multi - user access: multiplexing and multiple access, frequency division multiple access, time division multiple access, spread spectrum multiple access, space division multiple access, orthogonal frequency division multiple access, hybrid methods of multiple access, multiple access for packet radio systems, reservation based multiple access schemes

(14 Hours)

UNIT-4

Networking fundamentals: Wireless networks, open system interconnection reference model, transmission control protocol/internet protocol stack, peer to peer communication, transmission control protocol/internet protocol headers, medium access control, routing algorithms, transport control mechanisms, security aspects, application layers, mobile computing

Cellular networks: Global system for mobile telecommunication, general packet radio service, edge technology, CDMA based standards: IS-95 CDMA 2000, wireless local loop, IMT – 2000 and UMTS, long term evaluation, mobile satellite communication

Ad hoc networks: Introduction, Bluetooth, Wi-Fi standards, WiMAX standards, wireless sensor networks, ultra wideband **(10 Hours)**

Text Books:

1. Wireless Communication Networks, 1st Edition by upena dalal, Oxford university press.

Reference Books:

1. Mobile Cellular Communications, 2nd Edition by Willam C.Y.Lee Mc Graw Hill International Edition.
2. Wideband Wireless Digital Communication by Andreas F.Molisch, Pearson Education Edition..
3. Mobile Cellular Communication, 1st Edition by Gottapu Sasibhushana Rao, Pearson publication.
4. Wireless Communications., by T. S. Rappaport, Pearson.

INTELLIGENT INSTRUMENTATION (3-1-0)

Module I **(04 Hours)**

Science of Measurement: Units and Standards — Calibration Techniques — Classification of Errors — Error Analysis — Statistical Methods — Reliability — Static and Dynamic Characteristics of Transducers.

Module II **(12 Hours)**

Variable Resistance, Variable Inductance and Capacitance Transducers: Potentiometer — Strain Gauge — Resistance Thermometer — Hot Wire Anemometer — LVDT — Variable Reluctance Transducers - Variable Capacitive Transducers — Electromagnetic and Capacitor Microphone.

Module III **(12 Hours)**

Piezoelectric and Optical Transducers: Piezoelectric Transducer — IC sensors — Piezo-Resistive Sensors, Photoelectric, Hall-Effect, Optical Transducer- Principles — Types and Characteristics of Fibres — Fibre Optic Transducers for the Measurement of Temperature, Flow and Pressure. Interfacing Conventional Transducers with PC: Transducers with Frequency Output — Digital Transducers, Interfacing with PC.

Module IV **(12 Hours)**

Smart Instruments: Smart/Intelligent Transducer — Comparison with Conventional Transducers — Self Diagnosis and Remote Calibration Features — Smart Transmitter with HART Communicator —Micro Electro Mechanical Systems (MEMS) — Sensors, Actuators — Principles and Applications, Nonlinearity Compensation.

Text Books:

2. D. Patranabis- Principle of Industrial Instrumentation, TMH, 2000
3. A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhnpat Publications

References Books:

1. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990.
2. Chapman, P. Smart Sensors, ISA publication, 1995.

SOFT COMPUTING (3-1-0)

Module – I (02 hours)

Basic tools of soft Computing – Fuzzy logic, Neural Networks and Evolutionary Computing.

Module – II (14 hours)

Fuzzy Logic Systems : Basics of fuzzy logic theory, Crisp and fuzzy sets. Basic set operations. Fuzzy relations, Composition of Fuzzy relations, Fuzzy inference, Zadeh's compositional rule of inference. Defuzzificaiton. Fuzzy logic control: Mamdani and Takagi and Sugeno architectures. Applications to pattern recognition.

Module – III (14 hours)

Neural networks : Single layer networks, Perceptron. Activation functions. Adalinc: its training and capabilities, weights learning, Multilayer perceptrons : error back propagation, generalized delta rule. Radial basis function networks and least square training algorithm, Kohenen self – organizing map and learning vector quantization networks. Recurrent neural networks, Simulated annealing neural networks. Adaptive neuro-fuzzy information ;systems (ANFIS), Applications to control and pattern recognition.

Module—IV (10 hours)

Evolutionary Computing : Genetic algorithms -- Basic concepts, encoding , fitness function, reproduction. Differences of GA and traditional optimization methods. Basic genetic programming concepts Applications, Swarm Intelligence -- Particle swarm optimization and Ant colony optimization techniques.

Text Books:

1. F. O. Karry and C. de Silva, "Soft Computing and Intelligent Systems Design – Theory, Tools and Applications". Pearson Education. (printed in India).

Reference Books:

1. J. S. R. Jang. C. T. SUN and E. Mizutani, "Neuro-fuzzy and soft-computing". PHI Pvt. Ltd., New Delhi.
2. Fredric M. Ham and Ivica Kostanic, "Principle of Neuro Computing for Science and Engineering", Tata McGraw Hill.
3. S. Haykins, "Neural networks: a comprehensive foundation". Pearson Education, India.
4. V. Keeman, "Learning and Soft computing", Pearson Education, India.
5. R. C. Eberhart and Y. Shi, "Computational Intelligence Concepts to Implementation". Morgan Kaufmann Publishers (Indian Reprint).

NANOTECHNOLOGY (3-1-0)

Module-I **(10 Hours)**

Introduction: A definition, Some nano challenges, The fundamental science behind nanotechnology – Electrons, Atoms and ions, Molecules,Tools of Nanosciences: Tools for measuring nanostructures – Scanning probe instruments, Spectroscopy, Electrochemistry, Electron microscopy, Tools to make nanostructures: Scanning probe Instruments, Nanoscale lithography, Dip pen nanolithography, E-beam lithography, nanosphere liftoff lithography, Molecular Synthesis, Self-assembly, Nanoscale crystal growth, Polymerization, Nanobricks and building blocks, Tools to imagine nanoscale behaviour.

Module-II **(10 Hours)**

Points and Places of Interests: Smart materials, Sensors, Nanoscale biostructures, Energy Capture – transformation and storage, Optics, Magnets, Fabrications, Electronics, Modeling.Smart Materials: Self – healing structures, Recognition, Separation, Catalyst, Heterogeneous nanostructures and composites, Encapsulation, Consumer goods.

Module-III **(10 Hours)**

Sensors: Natural nanoscale sensors, Electromagnetic sensors, Biosensors, Electronic noses.Biomedical Applications: Drugs, Drug delivery, Photodynamic therapy, Molecular motors, Neuro-electronic interfaces, Protein engineering.

Module-IV **(10 Hours)**

Optics and Electronics: Light energy-its capture and photovoltaics, Light production, Light transmission, Light control ansd manipulation, Electronics, Carbon nanotubes, Soft molecule electronics, Memories, gates and switches. Nano business: Nanotechnology, The next industrial revolution, High tech – nano tech – bio tech, The investment landscape, Nano ethics.

Text Book:

1.Nanotechnology by M Ratner and D. ratner, Pearso Education Publication.

DSP ARCHITECTURE (3-1-0)

Module-I **(12 Hours)**

Computational characteristics of DSP algorithms and applications; their influence on defining a generic instruction-set architecture for DSPs, Architectural requirement of DSPs: high throughput, low cost, low power, small code size, embedded applications. Techniques for enhancing computational throughput: parallelism and pipelining.

Module-II **(12 Hours)**

Data-path of DSPs: multiple on-chip memories and buses, dedicated address generator units, specialized processing units (hardware multiplier, ALU, shifter) and on-chip peripherals for communication and control. Control-unit of DSPs: pipelined instruction execution, specialized hardware for zero-overhead looping, interrupts.

Module-III **(08 Hours)**

Architecture of Texas Instruments fixed-point and floating-point DSPs: brief description of TMS320 C5x /C54x/C3x DSPs; Programmer's model. Architecture of Analog Devices fixed-point and floating-point DSPs: brief description of ADSP 218x / 2106x DSPs; Programmer's model.

Module-IV **(08 Hours)**

Advanced DSPs: TI's TMS 320C6x, ADI's Tiger-SHARC, Lucent Technologies' DSP 16000 VLIW processors. Applications: a few case studies of application of DSPs in communication and multimedia.

Text Books:

1. P. Pirsch: Architectures for Digital Signal Processing; John Wiley, 1999.
2. R. J. Higgins: Digital Signal Processing in VLSI; Prentice-Hall, 1990.

Reference Books:

1. Texas Instruments TMSC5x, C54x and C6x Users Manuals.
2. Analog Devices ADSP 2100-family and 2106x-family Users Manuals.
3. K. Parhi: VLSI Digital Signal Processing Systems; John Wiley, 1999.
4. K. Parhi and T. Nishitani: Digital Signal Processing for Multimedia Systems; Marcel Dekker, 1999.
5. IEEE Signal Processing Magazine: Oct 88, Jan 89, July 97, Jan 98, March 98 and March 2000

HIGH LEVEL VLSI DESIGN (3-1-0)

Module-I **(12 Hours)**

Basic Concepts of Hardware Description Languages., Hierarchy, Concurrency, Logic and Delay Modeling, Structural, Data-Flow and Behavioral Styles of Hardware Description, Architecture of Event Driven Simulators, Syntax and Semantics of VHDL, Variable and Signal Types, Arrays and Attributes, Operators, Expressions and Signal Assignments, Entities, Architecture Specification and Configurations, Component Instantiation, Concurrent and Sequential Constructs, Use of Procedures And Functions, Examples of Design Using VHDL, Synthesis of Logic from Hardware Description.

Module-II **(10 Hours)**

CMOS Process and Masking Steps: Concept of Lambda, Design Rules, Layer Properties and Parasitic Estimation, Sheet Resistance, Capacitance Ratio for Layers, Concept of Tau, Quick Estimation of Delays. Design of Buffers and I/O Pads, CMOS Logic Design Styles and Their Comparison, CMOS Logic Design Styles and Their Comparison (Continued), from Specifications to Silicon, Abstraction Levels in VLSI Design.

Module-III **(10 Hours)**

Adder Architectures, Multiplier Architectures, Counter Architectures, ALU Architectures. Latches, Flip-Flops, Registers and Register Files. PLA Design, Gate Array Approach, Standard Cell Approach. Moore and Mealy Machines, PLA-Based Implementation, Random Logic Implementation, Micro-Programmed Implementation (ROM-Based Implementation)

Module-IV **(08 Hours)**

SRAM Cell, Different DRAM Cells, Arraying of Cells, Address Decoding, Read / Write Circuitry, Sense Amplifier Design, ROM Design. Clock Skew, Clock, Distribution and Routing, Clock Buffering, Clock Domains, Gated Clock, Clock Tree.

Text Books:

1. C. H. Roth, Digital Systems Design Using VHDL, Thomson Publications, Fourth Edition, 2002
2. V. A. Pedroni, Circuit Design with VHDL, MIT Press/PHI, 2004. (Cheap Edition)

Reference Books:

1. Z. Navabi, Verilog Digital System Design, Second Edition, Tata McGraw-Hill, 2008.
2. R. C. Cofer and B. F. Harding, Rapid System Prototyping with FPGAs: Accelerating the Design Process, Elsevier/Newnes.

INDUSTRIAL ELECTRONICS (3-1-0)

Module-I (10 Hours)

DC AMPLIFIERS: Need for DC amplifiers, DC amplifiers—Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers—Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.
REGULATED POWER SUPPLIES: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques— Short Circuit, Over voltage and Thermal Protection.

Module-II (10 Hours)

SWITCHED MODE & IC REGULATORS : Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators—Current boosting .
SCR AND THYRISTOR: Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors—Classes A, B, C, D, E and F, Ratings of SCR.

Module-III (10 Hours)

APPLICATIONS OF SCR IN POWER CONTROL: Static circuit breaker, Protection of SCR, Inverters—Classification, Single Phase inverters, Converters – single phase Half wave and Full wave.
DIAC, TRIAC AND THYRISTOR APPLICATIONS: Chopper circuits – Principle, methods and

Configurations, Diac and Triac, Triacs – Triggering modes, Firing Circuits, Commutation.

Module-IV (10 Hours)

INDUSTRIAL APPLICATIONS - I

Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding – Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.

INDUSTRIAL APPLICATIONS – II

High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications.Ultrasonics – Generation and Applications.

Text Books:

1. G.K. Mithal and Maneesha Gupta,Industrial and Power Electronics –Khanna Publishers, 19th Ed., 2003.
2. J. Millman and C.C Halkias,Integrated Electronics, McGraw Hill, 1972.

Reference Books :

1. Theodore.H.Bogart, Electronic Devices and circuits –Pearson Education,6th Edn., 2003.
2. M. Rammurthy,Thyristors and applications –East-West Press, 1977.
3. Deboo and Burroughs,Integrated Circuits and Semiconductor Devices –ISE.
4. M. H. Rashid, “Power Electronics”, PHI Publisher

LIST OF OPEN ELECTIVE
INFORMATION THEORY & CODING (3-1-0)

Module –I **(10Hours)**

Waveform coding: Antipodal and Orthogonal signals, Orthogonal and Biorthogonal codes, waveform coding system example, Types of error control: Terminal connectivity, automatic repeat request Structured Sequence: Channel models, Channel capacity, Channel coding, Information Capacity Theorem, The Shannon Limit, Introduction to Error correcting codes, code rate & redundancy, parity check codes: Single parity check code, Rectangular code Linear Block codes: vector spaces, vector subspaces, A(6,3) linear block code example, Generator matrix, systematic linear block codes, parity-check matrix, syndrome testing, error correction , Decoder implementation Error Detecting & Correcting Capability: weight & distance of binary vectors, minimum distance of linear code, error detection & correction, visualization of a 6-tuple space, erasure correction Usefulness of Standard Array: estimating code capability, an (n, k) example, designing the (8,2) code, error detection vs. error correction trade-off

Cyclic Codes: algebraic structures of cyclic code, binary cyclic code properties, encoding in systematic form, circuit for dividing polynomial, systematic encoding with an (n-k)-stage shift register, error detection with an (n-k)-shift register Well-Known Block Codes: Hamming codes, extended Golay code, BCH codes.

Module –II **(10Hours)**

Convolutional Encoding, Convolutional Encoder Representation: connection representation, state representation & the state diagram, the tree diagram, the trellis diagram Formulation of the Convolutional Decoding Problem: maximum likelihood decoding, channel models: hard versus soft decisions, Viterbi Convolutional Decoding Algorithm, an example of viterbi convolutional decoding, decoder implementation, path memory and synchronization Properties of Convolutional Codes: distance properties of convolutional codes, systematic & non-systematic convolutional codes, catastrophic error propagation in convolutional codes, performance bounds for convolutional codes, coding gain, based known convolutional codes, convolutional code rate trade-off, soft-decision viterbi decoding Other Convolutional Decoding Algorithms: sequential decoding, comparisons & limitations of viterbi & sequential decoding, feedback decoding.

Module –III **(10Hours)**

Reed-Solomon Codes: Reed-Solomon Error Probability, Why R-S codes perform well against burst noise, R-S performance as a function of size, redundancy, and code rate Interleaving & Concatenated Codes: Block interleaving, Convolutional interleaving, concatenated codes Coding & Interleaving Applied to CD Digital Audio System: CIRC encodings, CIRC decoding, interpolation & muting Turbo Codes: turbo code concepts, log-likelihood algebra

Module –IV **(10Hours)**

Modulation and Coding Trade Offs

Goals of the Communications System Designer, Error Probability Plane, Nyquist Minimum Bandwidth, Shannon-Hartley Capacity Theorem, Bandwidth Efficiency Plane, Modulation and Coding Trade-Offs, Defining, Designing, and Evaluating Digital Communication Systems, Bandwidth Efficient modulation, Modulation and Coding for Bandlimited Channels, Trellis-Coded Modulation,

Source coding and its implementation.

Text Books:

1.Digital Communications - Fundamentals and Applications - Bernard Sklar, 2nd Edition of PersonEducation Publication

2. Information Theory, Coding & Cryptography - Ranjan Bose, TMH Publication

Reference Book:

1. Digital Communications – Simon Haykin, Wiley Edition

OPTO-ELECTRONIC DEVICES (3-1-0)

Module I **(12 Hours)**

Sources: Light Emitting Diodes (LEDs), LED Structures, Light Source Materials, Internal Quantum Efficiency, Modulation Capacity, Transient Response, Power – Bandwidth Product, Laser Diodes, Laser Diode Modes and Threshold Conditions, Resonant Frequencies, Laser Diode Structures and Radiation Patterns, Single Mode Lasers, Modulation of Laser Diodes, Temperature Effects, Light Source Linearity, Modal, Partition, and Reflection Noise.

Module II **(08 Hours)**

Detectors: PIN Photo-Detector, Avalanche Photodiodes, Photo-Detector Noise, Noise Sources, Signal-to-Noise Ratio, Depletion Layer Photocurrent, Response Time, Avalanche Multiplication Noise, Temperature Effects on Avalanche Gain, Photodiode Materials.

Module III **(10 Hours)**

Amplifiers and Switches: Optical Amplifiers, Semiconductor Laser Amplifiers, Fiber Amplifiers, Rare Earth Doped Fiber Amplifiers, Raman Fiber Amplifiers, Brillouin Fiber Amplifiers, Amplifier Gain, Noise Figure, Bandwidth, Photonic Switching, Integrated Optical Switches.

Module IV **(10 Hours)**

Connectors and Couplers: Cylindrical Ferrule Connector, Bi-Conical Ferrule Connectors, Double Eccentric Connectors, Duplex Fiber Connectors, Expanded Beam Connectors, Beam Splitter, Three Port Couplers, Four Port Couplers, Directional Couplers, Star Couplers, Lenses for Coupling Improvement.

Text Books:

1. Optical Fiber Communications by G. Keiser. 3rd Edition, Mc Graw Hill Book Co.
2. Fiber Optic Communications Technology by D. K. Mynbaev & Lowell L. Scheiner – Pearson Education.

Reference Books:

1. Optical fibers and Fiber Optic communication systems by Subir Kumar Sarkar, Publication: S. Chand & Co.
2. Fiber Optic communications By Joseph C. Polish 4th Edition, Pearson Publication Asia.

MOBILE COMPUTING (3-1-0)

Module-1 **(10 Hours)**

Introduction to Personal Communications Services (PCS): PCS Architecture, mobility management, Networks signaling, Global system for Mobile Communication (GSM) System overview: GSM architecture, Mobility management, Network signaling. General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard, Mobile IP.

Module-II **(10 hours)**

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, Wireless mark up Languages (WML), Wireless Local Loop (WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. Third Generation (3G) Mobile Services: Introduction to international Mobile Telecommunications 2000 (IMT 2000) Vision, Wideband Code division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

Module-III **(12 hours)**

Global Mobile Satellite Systems; Case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

Module-IV **(8 hours)**

Server-side programming in Java, Pervasive web application architecture, Device independent example application.

Text Books:

1. “Pervasive Computing”, Burkhardt, Pearson.
2. “Mobile Communication”, J. Schiller, Pearson

Reference Books:

1. “The Wireless Application Protocol”, Sandeep Singhal, Pearson
2. “Mobile Communication”, Raj Kamal, Oxford University Press
3. “Guide to Designing and Implementing Wireless LANs”, Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
4. “Wireless Web Development”, Ray Rischpater, Springer Publishers.
5. “The Wireless Application Protocol”, Sandeep Singhal , Pearson.
6. “The Generation Mobile telecommunication systems”, by P. Stavronlakis, Springer Publishers.

ADVANCED DIGITAL SIGNAL PROCESSING

Module-I **(10 Hours)**

Multirate Digital Signal Processing:

Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by rational factor I/D, Filter Design and Implementation for sampling-rate, Multistage implementation of sampling rate conversion, Sampling rate conversion of Band pass signal, Application of multi rate signal processing: design of phase shifters, Implementation of narrowband lowpass filters. Implementation of Digital filter banks. Filter

Bank and Sub-band Filters and its applications.

Module-II **(10 Hours)**

Linear prediction and Optimum Linear Filters:

Innovations Representation of a stationary random process, Forward and Backward Linear Prediction, Solution of the normal equations, Properties of the linear prediction-error filters, AR lattice and ARMA lattice- ladder filters, Wiener filter for filtering and Prediction: FIR Wiener Filter, Orthogonality Principle in linear meansquare estimation.

Module-III **(8 Hours)**

Power Spectrum Estimation:

Estimation of spectra from finite-duration observation of signals, Non parametric method for power spectrum estimation: Bartlett method, Blackman and Turkey method, parametric method for power estimation: YukeWalker method, Burg method, MA model and ARMA model.

Module-IV **(12 Hours)**

Adaptive Signal Processing:

Basics of Wiener filtering, Widrow-Hopf Equation, Least mean square algorithm, Recursive least square algorithm, variants of LMS algorithm: FX-LMS, Fast LMS, N-LMS, PN-LMS. Design of Adaptive FIR & IIR filters, Application of adaptive signal processing: Adaptive linear combiner, System identification, Channel equalization, adaptive noise cancellation, adaptive line enhancer.

Text Books:

1. Digital Signal Processing, Third Edition, J.G. Proakis and D.G. Manolakis, Prentice Hall.
2. Adaptive Signal Processing, B. Widrow and Stern.

Reference Books:

1. Digital Signal Processing, by Sanjit K Mitra, new edition, TMH.
2. Digital Signal Processing, by Salivahanan, new edition, TMH.

BIO-MEDICAL INSTRUMENTATION (3-1-0)

Module –I **(10 Hours)**

Biometrics, Man-Instrument System, Problems Encountered in Measuring a Living System. Review of Transducers, Transducers for Biomedical Applications. Sources of Bioelectric Potentials - Resting and Action Potentials. Propagation on action Potentials. Bioelectric Potentials– Electrocardiogram. Typical Human Electroencephalogram., Electromyogram. Electrodes: Electrode Theory, Biopotential Electrodes, Microelectrodes, Body Surface Electrodes. Biochemical Transducers – the pH Electrodes, Blood Gas Electrodes.

Module –II **(10 Hours)**

Cardiovascular Measurements: Electrocardiography, Measurement of Blood Pressure – Programmed Electrosphygm Manometer. Measurement of Blood flow and Cardiac output, Measurement of Heart Sounds Frequency Spectrum of heart.

Module-III **(10 Hours)**

Measurements on Nervous System: Psycho physiological Measurement- Polygraph, EEG, Brain Imaging-X-Ray, Computed Tomography (CT), MRI, Eye Electrorefinogram (ERG), Opthalmoscopy, Audiometry, Electromyography (EMG). Measurement in Respiratory System: Pulmonary Volume and its measurement-Spiro meter, Pneumotachometer, Kidney Image: Pyelogram, Hemodialysis, Peritonal Dialysis, Skin: Water loss, Flow Hygrometry, Colour Dermaspectrometer.

Module-IV **(10 Hours)**

Noninvasive Diagnostic Measurements: Body Temperature Measurement: Electronics Thermo meter, Skin Temperature Measurement-Thermography, Principle of Ultrasonic measurement - Ultrasound, Modes of Transmission, Ultrasonic imaging, Ultrasonic diagnosis. Computers in Biomedical Instrumentation, Computer Analysis of Electro Cardiogram, Patient Monitoring, Computerized Axial Tomography (CAT) Scanner and other applications.

Text Books:

1. Biomedical Instrumentation and Measurements, 2nd Edition, by L. Cromwell, F. J. Weibell and E. A. Pfeiffer, Pearson Education.
2. Bioinstrumentation by John. Webster-editor, John Willey students' Edition.

Reference Books:

1. Introduction to Biomedical Equipment Technology, 4th Edition by Joseph J. Carr and John M. Brown, Pearson Education.
2. Biomedical Digital Signal Processing – By Willis J. Tompkins-Editor, Prentice Hall of India.

CRYPTOGRAPHY AND NETWORK SECURITY (3-1-0)

Module I **(12 Hours)**

Introduction and Mathematical Foundations– Introduction, Overview on Modern Cryptography, Number Theory, Probability and Information Theory.

Classical Cryptosystems, Cryptanalysis of Classical Cryptosystems, Shannon's Theory: I, Shannon's Theory: II, Shannon's Theory: III.

Module II **(8 Hours)**

Symmetric Key Ciphers – Symmetric Key Ciphers, Modern Block Ciphers (DES), Modern Block Cipher (AES).Cryptanalysis of Symmetric Key Ciphers – Linear Cryptanalysis, Differential Cryptanalysis, Other Cryptanalytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers.

Stream Ciphers and Pseudorandomness – Stream Ciphers, Pseudorandom functions. Hash Functions and MACs – Hash functions: The MerkleDamgard Construction, Message Authentication Codes (MACs).

Module III **(11 Hours)**

Asymmetric Key Ciphers: Construction and Cryptanalysis – More Number Theoretic Results, The RSA Cryptosystem, Primality Testing, Factoring Algorithms, Other attacks on RSA and Semantic Security of RSA, The Discrete Logarithm Problem (DLP) and the Diffie Hellman Key Exchange algorithm, The ElGamal Encryption Algorithm, Cryptanalysis of DLP.

Digital Signatures – Signature schemes: I, Signature schemes: II.

Modern Trends in Asymmetric Key Cryptography – Elliptic curve based cryptography: I, Elliptic curve based cryptography: II.

Module IV **(9 Hours)**

Network Security –Secret Sharing Schemes, Kerberos, Pretty Good Privacy (PGP), Secure Socket Layer (SSL), Intruders and Viruses, Firewalls.

Text/Reference Books:

1. Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.
2. B. A. Forouzan, "Cryptography & Network Security", McGraw Hill.

Reference Book:

1. W. Stallings, "Cryptography and Network Security", Pearson Education.

LOW POWER VLSI DESIGN (3-1-0)

Module-I **(12 Hours)**

Introduction: Need for Low Power VLSI Chips, Sources of Power Dissipation on Digital Integrated Circuits. Emerging Low Power Approaches, Physics of Power Dissipation In CMOS Devices, Device & Technology Impact on Low Power: Dynamic Dissipation In CMOS, Transistor Sizing & Gate Oxide Thickness, Impact of Technology Scaling, Technology & Device Innovation, Power Estimation, Simulation Power Analysis: SPICE Circuit Simulators, Gate Level Logic Simulation, Capacitive Power Estimation, Static State Power, Gate Level Capacitance Estimation, Architecture Level Analysis, Data Correlation Analysis in DSP Systems, Monte Carlo Simulation. Probabilistic Power Analysis: Random Logic Signals, Probability & Frequency, Probabilistic Power Analysis Techniques, Signal Entropy.

Module-II **(08 Hours)**

Low Power Design: Circuit Level: Power Consumption In Circuits. Flip Flops & Latches Design, High Capacitance Nodes, Low Power Digital Cells Library Logic Level: Gate Reorganization, Signal Gating, Logic Encoding, State Machine Encoding, Pre-Computation Logic.

Module-III **(12 Hours)**

Low Power Architecture & Systems: Power & Performance Management, Switching Activity Reduction, Parallel Architecture with Voltage Reduction, Flow Graph Transformation, Low Power Arithmetic Components, Low Power Memory Design. Low Power Clock Distribution: Power Dissipation in Clock Distribution, Single Driver Vs Distributed Buffers, Zero Skew Vs Tolerable Skew, Chip & Package Co Design of Clock Network

Module-IV **(08 hours)**

Algorithm & Architectural Level Methodologies: Introduction, Design Flow, Algorithmic Level Analysis & Optimization, Architectural Level Estimation & Synthesis.

Text Books:

1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, ” Kluwer Academic Press, 2002
2. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000

Reference Books:

1. Rabaey, Pedram, “Low power design methodologies” Kluwer Academic Press, 1997

2. Low Power Design in Deep Sub-micron Electronics by W. Nebel and J. Mermet, Kluwer Academic Publishers, 1997

DIGITAL SWITCHING AND TELECOM NETWORKS (3-1-0)

Module – I **(16 hours)**

Introduction**:** Fundamentals of switching system, telecommunication networks.

Electronic space division switching**:** Stored program control, centralized and distributed SPC, application software architecture, enhanced services, two and three stage & n stage networks. Time Division Switching: Basic time division space switching, time division time switching, time multiplexed space and time switching, combination switching, three-stage & n stage combination switching. (Chapter 1, 4 and 6)

Module – II **(12 hours)**

Traffic Engineering: Network traffic load and parameters, Grade of services & blocking probability, modelling of switching systems, incoming traffic & service time characterization, blocking models and loss estimates, Delay systems (Chapter 8)

Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, Signalling techniques : in channel & common channel signalling (Chapter 9)

Module – III **(12 hours)**

Data Networks: Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, an overview of data network standards. (Chapter 10)

Integrated Service Digital Network: Motivation, new services, transmission channels, signalling, service characterization, ISDN standards, broad band ISDN, voice data integration (Chapter 11)

Text Books :

1. Telecommunication Switching Systems and Networks by Thiagarajan Viswanathan, , PHI Learning Pvt. Ltd., New Delhi.

References:

1. Communication Networks, A Leon-Garcia and Indra Widiaja, TMH, New Delhi
2. Data and Computer Communications by W Stallings, Pearson Education