# GOA UNIVERSITY

## SECOND YEAR OF BACHELOR'S DEGREE COURSE IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING (REVISED COURSE-2007) SCHEME OF INSTRUCTION AND EXAMINATION

**SEMESTER III,**

| Sub code | Subjects | Scheme Of Instruction Hrs/Week | | | Scheme Of Examination | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Th. Dur (Hrs) | Marks | | | | |
| | | L | T | P | | Th. | S | P | O | Total |
| 3.1 | Applied Mathematics-III | 4 | 0 | - | 3 | 100 | 25 | - | - | 125 |
| 3.2 | Digital System Design | 4 | 0 | 2 | 3 | 100 | 25 | 50 | - | 175 |
| 3.3 | Network Analysis and Synthesis | 3 | 1 | 2 | 3 | 100 | 25 | - | | 125 |
| 3.4 | Electronic Devices and Circuits | 3 | 1 | 2 | 3 | 100 | 25 | 50 | | 175 |
| 3.5 | Managerial Economics | 4 | 0 | - | 3 | 100 | 25 | - | - | 125 |
| 3.6 | Computer Oriented Numerical Techniques | 4 | 0 | 2 | 3 | 100 | 25 | - | - | 125 |
| | **Total** | **22** | **2** | **8** | | **600** | **150** | **100** | | **850** |

L – Lectures, T-Tutorials, P-Practicals.
Th. Dur. – Duration of Theory Paper
Th – Theory, S – Sessional, P– Practical, O – Oral.

**SEMESTER IV,**

| Sub code | Subjects | Scheme Of Instruction Hrs/Week | | | Scheme Of Examination | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Th. Dur (Hrs) | Marks | | | | |
| | | L | T | P | | Th. | S | P | O | Total |
| **4.1** | Applied Mathematics-IV | 4 | 0 | - | 3 | 100 | 25 | - | - | 125 |
| **4.2** | Signals and Systems | 3 | 1 | 2 | 3 | 100 | 25 | - | 50 | 175 |
| **4.3** | Electrical Technology | 4 | 0 | 2 | 3 | 100 | 25 | - | | 125 |
| **4.4** | Electro magnetic Fields and Waves | 3 | 1 | - | 3 | 100 | 25 | - | - | 125 |
| **4.5** | Linear Integrated circuits | 4 | 0 | 2 | 3 | 100 | 25 | 50 | - | 175 |
| **4.6** | Data structures using $C^{++}$ | 4 | 0 | 2 | 3 | 100 | 25 | - | - | 125 |
| | **Total** | **22** | **2** | **8** | | **600** | **150** | **50** | **50** | **850** |

L – Lectures, T-Tutorials, P-Practicals.
Th. Dur. – Duration of Theory Paper
Th – Theory, S – Sessional, P– Practical, O – Oral.

## 3.1 APPLIED MATHEMATICS III

### MODULE I

Matrices: Types of matrices, Determinant, adjoint, inverse of matrix, elementary transformation, (2Hrs)
Elementary matrices, Rank of matrix, Reduction to normal form, canonical form. (3Hrs)
Rank using elementary transformation, Linear independence end dependence. (2Hrs)
System of the form AX=0 and AX=B, their solutions. (3Hrs)

### MODULE II

Eigen values, Eigen vectors with properties. (2Hrs)
Cayley Hamilton theorem with Applications. Minimal polynomial, Diagonalisation. (3Hrs)
Fourier Series: Fourier Series, Fourier series of Periodic functions, Trigonometric Series, Euler's formulas, Dirichlets condition, Even and Odd functions, Half range series, Parseval's Identity. (5Hrs)

### MODULE III

Laplace Transforms: Definition, Existence condition, Properties, (3Hrs)
Inverse Laplace Transform. Laplace Transform of periodic functions, Convolution theorem, Laplace Transform of Dirac-Delta function. (5Hrs)
Applications of Laplace Transform in solving linear differential equations with initial conditions and system of linear simultaneous differential equations. (2Hrs)

### MODULE IV

Fourier Transforms: Properties, Inverse Fourier Transform, convolution, Applications. (5Hrs)
Z- Transforms: Properties, inverse, convolution and applications to deference equations. Wave equation-derivation and solution using separation of variable method. (5Hrs)

**TEXT BOOKS:**


1. Higher Engineering Mathematics by B.S.Grewal, Khanna Publications
2. Advanced Engineering Mathematics: Erusing Kreyszig, New International Ltd


**REFERENCE BOOKS:**


1. Theory and Problems of Matrices: Fraank Ayres, Schaum Outline Series
2. Signals and DSP: Xavier, S. Chand Publication
3. Matrix and Linear Algebra: Datta K.B., PHI
4. Engineering Mathematics Vol III: Kandasamy P, S. Chand & Co.
5. Advanced Engineering Mathematics: H. K. Dass, S. Chand

## 3.2 DIGITAL SYSTEM DESIGN

### MODULE I

Number Systems & Codes:
Decimal, Binary, Hexadecimal, Octal systems; Interconversions, Signed & Unsigned Binary numbers, Complements, Binary Arithmetic: Addition & Subtraction using 1's & 2's complements; 2 hours

Binary Codes-Decimal codes (BCD, Excess-3, 8421, 2421), Error Detection codes (Parity generation & Detection), Reflected code, Alphanumeric codes (EBCDIC, ASCII), Study of Binary logic with logic gates. 2 hours

Boolean Algebra:
Postulates & Theorems, Boolean functions and their Algebraic manipulation, Canonical & Standard forms, Minterms & Maxterms, 3 hours
Simplification of Boolean functions: K-maps, POS & SOP simplification and their interconversions, NAND & NOR implementation, Plotting & Reading of K-map using VEM. 3 hours

### MODULE II

Combinational Logic:
Design Procedure for Combinational logic circuits, Design & Analysis of Adder, Subtractor, Code Conversion, 2 hours
binary Parallel Adder, Look-ahead Carry generator, Decimal Adder (BCD Adder), Magnitude Comparator, Decoders, 2 hours
Combinational logic implementation, Demultiplexers, Encoders, Multiplexers, Boolean function implementation with multiplexers. 2 hours

Flip-flops: Basic flip-flop circuit, Clocked RS flip-flop, D flip-flop, JK flip-flop, T flip-flop, Triggering of flip-flops, Master Slave flip-flop, Edge triggered flip-flops: their schematic symbols, truth table & Excitation table. 4 hours

### MODULE III

Sequential Circuits: Design procedure for sequential circuits using state diagrams, 1 hour
state table, state equations, state reduction and assignment, Circuit implementation, 2 hours
Moore & Mealy Machine. 1 hour
Design and analysis of counters, Modulo Counters, Synchronous, Ripple and ring counters (Switch tail, Johnson), Application of counters, Timing Sequences, Word time generation, timing signals. 3 hours
Registers: SISO, SIPO, PISO, PIPO, Register with parallel load, Shift registers, Bidirectional shift register with parallel load. 3 hours

### MODULE IV

Digital Logic families:
Characteristics of Digital ICs, RTL, DTL, 2 hours
TTL-Operation of TTL NAND gate, Active pull-up, Open Collector output, Wired AND, three state (or tri-state) output, Schottky TTL,
ECL, $I^2L$. 4 hours
Characteristics of MOSFET's, CMOS Inverter, NAND and NOR, CMOS to TTL and TTL to CMOS interfacing. 1 hours
Noise Considerations: Types of Noise and Control methods, Shielding, Grounding and Decoupling, Crosstalk. (Refer Reference book:5) 1 hour

Memories:-Memory organization and operation: Write operation, read operation. Expanding memory size: Expanding Word size, Expanding Word Capacity, Basic concepts of RAM, ROM. 2 hours

**TEXT BOOKS:**


1. M. Morris Mano, Digital Logic and Computer Design.-PHI
2. Tocci, Digital Systems-Principles & Applications-PHI


**REFERENCE BOOKS:**


1. William Fletcher, An Engineering Approach to Digital Design-PHI
2. M. Morris Mano, Digital Design-PHI
3. Malvino & Leach, Digital Principles & Applications-Tata McGraw-Hill
4. Thomas Floyd, Digital Fundamentals-UBS Publishers & Distributors
5. Designing with TTL integrated circuits by Robert Morris & John Miller

## 3.3 NETWORK ANALYSIS AND SYNTHESIS

### MODULE I

Network classification: Distributed and lumped, passive and active, time variable and time invariant, symmetrical and asymmetrical networks. Network analysis: Mesh and nodal analysis; super-node and super-mesh analysis 3Hrs

T-Pi and Pi-T, conversions, Network theorems: Review of Thevenin's, Norton's, Superposition, Millman's Theorem 4Hrs

Compensation,Reciprocity Tellgen's, Substitution, Superposition and Maximum power transfer Theorems. 3 Hrs

### MODULE II

Graph theory: Basic definitions, matrices associated with networks graphs: Incidence, Cutset, Tieset Matrices and Duality. Applications to Mesh & Nodal Analysis**.** 4Hrs

Time-Domain Analysis: Network equations in time-domain, first and second-order circuits, initial conditions, analysis of transient and steady state response to step, ramp, impulse and sinusoidal inputs. 3Hrs

Application of Laplace Transform to analysis of networks for different inputs (impulse, step, ramp and sinusoidal) 3Hrs

### MODULE III

Resonance: Series resonance- Band Width, selectivity and Q-factor of resonance circuits. 3Hrs

parallel resonance- Band Width, selectivity and Q-factor of resonance circuits**.** 3Hrs

Two port networks: Characterisation in terms of Z, Y, H and ABCD parameters, Equivalent circuits, inter-relationship between the two port parameters; Input, output, characteristic impedance and image impedances of two ports**.** 4Hrs

### MODULE IV

Attenuators and filters: Symmetrical and unsymmetrical, balanced and unbalanced attenuators; analysis and design of T, Pi, Lattice and Bridged-T attenuator. Types of filters-Low pass, high pass, band pass and band elimination filter. 4Hrs

Basics of Butterworth, Chebyshev, Inverse Chebyshev and Elleptic approximations. 3Hrs

Elements of network synthesis: Positive-real functions, Reactance functions, RL and RC functions (Foster method and Caver Method**)** 3Hrs

**TEXT BOOKS**:


1. Franklin F. Chuo, Network Analysis And Synthesis, Wiley Eastern
2. Circuits and networks – Sudhakar & Shyamohan
3. Networks & Systems – Roy Choudhary


**REFERENCE BOOKS:**


1. N. Balabanian, T.A. Bichkart and Sundaran Seshu- Electric Network Theory, Wiley &sons
2. L. O. Chau, C.A. Desoer and E.S. Kuyh, Linear and Non-linear Circuits, McGraw Hill International,1987
3. M.E. Vanvalkenbarg, Network Analysis, Prentice (I) Ltd.
4. L.O Chau, C.A. Desoer, E.S Kuh, Linear and Nonlinear Circuits, McGraw Hill International edition,.1987

## 3.4 ELECTRONIC DEVICES & CIRCUITS

### MODULE I

Filters: Design of C, L and LC types. Zener Voltage Regulators: 2 hrs
Modeling of BJT: h-parameter and re model for all biasing circuits, Miller's theorem. 3 hrs
Multistage amplifiers-direct, RC-coupled and transformer coupled, Darlington pair, Cascade, Cascode. 3hrs
Large signal amplifiers: Class A,B,C,D (derivation for efficiency), complementary symmetry and push-pull amplifiers. 2 hrs

### MODULE II

Steady state response of RC differentiator & integrating circuits to square wave, BJT as a switch, Junction & Diffusion Capacitance of a BJT , Improving switching times, 3hrs
Analysis & Design of Basic BJT Monostable Multivibrator, 2hrs
BJT Bistable Multivibrator, 1hrs
BJT Astable Multivibrator, 1hrs
and BJT Schmitt trigger. 1hrs
Sampling gates: UJT, JFET and MOSFET Sampling gate, Sample & Hold circuits. Transistor bootstrap ramp generator. 2hrs

### MODULE III

Principle of negative feedback in electronic circuits, Voltage series, Voltage shunt, current series, current shunt types of negative feedback, 2hrs
Typical transistor circuits effects of negative feedback on input & output impedance, voltage & current gains, Bandwidth, Noise & Distortion. 3hrs
Principle of positive feedback, concept of stability in electronic circuits, Barkhausen criteria for oscillations, 1hr
various types of oscillators-RC, Clapps, Wein Bridge, Colpitt, Hartley, Tuned LC, 3 hrs
UJT Relaxation oscillator, Crystal Oscillators (Working and Derivation of frequency of oscillation) 1hr

### MODULE IV

Intrinsic & Extrinsic Semiconductors, types of doping & its effect on properties of Semiconductors, Diffusion, Mass-action law, Graded Semiconductors. 2hrs
Conduction mechanism in Semiconductors, Carrier density and conductivity of intrinsic Semiconductors, Drift & Diffusion currents, hall effect, Continuity equation, Qualitative treatment of pn junction diode. 3 hrs
Superconductivity: Meissner effect, Single particle tunneling, Josephson Superconductor. 2 hrs
Introduction to MEMS: Materials, Application ; Introduction to Nanotechnology: Materials, Application. 3hrs

**TEXT BOOKS :**


1. Electronic Devices and circuits – Millman and Halkias – McGraw Hill Publications
2. Solid State Electronic Devices – B.G. Streetman - PHI


**REFERENCE BOOKS:**


1. Physics of Semiconductor Devices by S.M.Sze - Wiley Publication
2. Electronic Devices & Linear circuits by Garud & Jain. (Tata McGraw Hill)
3. Electronic Devices and Circuit Theory – Robert Boylestead and Louis Nashelsky – PHI Publications
4. Solid State Pulse Circuits by David Bell.
5. Electronic Devices and Circuits – Allen Mottershed – PHI Publications

6. Electrical Engineering materials – A.J. Dekkar – PHI
7. Introduction to Solid State physics by Charles Kittel.- Wiley Publication
8. Nanoelectronics & Nanosystems by Glosekotter-Denstube
9. Tai-Ran Hsu, MEMS & Microsystems: Design and Manufacture. McGraw Hill, New York, 2002.
10. Nadim Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House, 2000.

## **3.5** Managerial Economics

**MODULE I**

Introduction and general concepts :Demand and supply – Demand curve, Equilibrium, Aggregate Supply and Demand. 2 hrs

National Income terms-GDP, Real v/s Nominal GDP, Net Domestic Product, GNP, National Income, Per capita income, Disposable Income,Price Index, 2 hrs

Inflation 1 hrs

Exchange Rates – Pure, flexible, Terminology for Exchange rate changes, Forex market, Exchange rate systems. 2 hrs

Individual, firm and Market Demand and Supply, Price, Income and Cross Elasticity Applications of Elasticity, Estimation/forecasting of Demand. 2 hrs

Pricing of multiple Products, Price Discrimination, Cost plus pricing, Market driven pricing decisions 1 hr

**MODULE II**

Costing And Financial Analysis: Break even Analysis, Basic Concepts-Contribution Cost, Break-even Volume, break-even revenue. 2 hrs

Preparation of Income statement, Balance sheet, fund Flow statement, 2 hrs

Understanding and analyzing them using financial ratios. Ratio Analysis Liquidity, Leverage and Profitability ratios 2 hrs

Working Capital Management-Determinants of working capital, Financing of working Capital, Dangers of Excessive and shortage of working Capital. 1 hr

Inviting investment proposals, Selection of project proposals. Capital Rationing, different Methods of Evaluation of Project-Payback Period Accounting rate of return. Discounted cash Flow Methods – Net Present Value, Internal Rate of return, Profitability Index, 2 hrs

Sources of funds for Business-Share capital, Debentures, Loans 1 hr

**MODULE III**

General Principles Of Management: Different schools of Management, effectiveness, efficiency, Productivity, functions of Managers, 2 hr

Planning, Types of plans.Nature of Objectives, MBO, Merits and Demerits of MBO.Organisation, Purpose, Span of management, 2 hrs

Departmentation, Structure of Organisation, O. D. Process, Organisational culture, values. Matrix Organisation, Unity of command, SBU, line and staff function, 3 hrs

Decentralization, Advantages, Limitations, Marketing Mix, Advertisement, Sale Promotion, Sales Management and Training, Market Research –Tools, Methods, Analysis 3 hrs

**MODULE IV**

Managing People: Motivation, Theories of Motivation, Maslow's Theory of Needs, Herzberg's Theory, Vroom's expectancy theory, Managing Creative Staff. 2 hrs

Leadership, leadership styles and behaviors. Human Resource Management, Staffing, Skills needed by Mangers, Recruitment and Selection, Appraisal Methods, 4 hrs

Nature of Communication, Basic communication Process, Barriers in Communication, Guidelines for improved communication, Informal and formal communication, Principles of Effective communication 2 hrs

Controlling, steps in Basic control process, Importance of Standards. 2 hr

**TEXT BOOKS :**

1. Varshney &Maheswari, Managerial Economics
2. Koontz, Harold and Weihrich Heinz, Essentials of Management, Tata McGraw Hill, New Delhi, 1998
3. Peterson, Lewis, Managerial Economics, Prentice-Hall

**REFERENCE BOOKS:**

1. Samuelson P.A., Economics, McGraw – Hill, 1998
2. Stoner, James, Freeman, Edward R. and Gilbert, Daniel R., Management, Prentice Hall, New Delhi, 1999
3. Hicks, Phillip E., Industrial Engineering and Management, McGraw Hill, New York,2994
4. Riggs, Bedworth, Randhawa, engineering Economics, Tata McGraw Hill.
5. Sepulveda, Schaum's Outlines.
6. Homgren, Datar, foster, Cost Accounting, Prentice – Hall.
7. Nellis, Parker, Essence of Business Economics

## 3.6 COMPUTER ORIENTED NUMERICAL TECHNIQUES

### MODULE I

Errors and Approximations: introduction, sources of errors, problems in computations, safeguards against errors,floating point arithmetic, absolute error, relative error, percentage error- calculations. 3 hrs

Forward and backward differences, Newton's interpolation formula (Forward and backward ) 3 hrs

Lagrange's Interpolation, Newton's Dividend difference interpolation formula. Cubic spline interpolation and C programmes for all above methods. 4 hrs

### MODULE II

Solution of transcendental and polynomial equations in one variable by using Newton Raphson method, Regula Falsi method 3 hrs

Bisection method and Secant method 3 hrs

C programmes for all above methods. 4 hrs

### MODULE III

Solution of linear equations: Gauss's Elimination, pivoting, computation of matrix inverse using Gauss Elimination, Gauss Jordan methods. 3 hrs

Iterative Algorithms – Jacobi and Gauss Seidal methods, Eigen values and Eigen vectors by using power method 3 hrs

C programmes for all above methods. 4 hrs

### MODULE IV

Numerical Integration: Trapezoidal rule & Simpson's rule (one third and three eights), Romberg's formula. 3 hrs

Numerical Differentiation: Newton's forward and backward difference formulae. Solutions of ordinary differential equation, Euler's methods, Runge Kutta methods, Predictor Corrector method (Euler's, Milne and Adams Methods) 4 hrs

C programmes for all above methods. 3 hrs

**TEXTBOOKS:**

1. Numerical Methods – E. Balaguruswamy, TMH.
2. Numerical methods in Engineering & Science Dr. B. S. Grewal - Khanna Publication

**REFERENCE BOOKS:**

1. Computer Oriented Numerical methods – Rajaraman – PHI
2. Introduction methods of numerical analysis – S. S. Sastry – PHI

## 4.1 APPLIED MATHEMATICS IV

### MODULE I

Bessel's and Legendre's equations and their solutions, (3Hrs)
Bessel's functions of first kind and second kind. Recurrence relations for Bessel's functions of first kind and applications. (2Hrs)
Orthogonality for Bessel's functions and Bessel's Fourier series. (2Hrs)
Generating functions for Bessel's functions. Relation between Laplace equation and Bessel's equation. (3Hrs)

### MODULE II

Series solution for Legendre's equation and Legendre's polynomials, (3Hrs)
Recurrence relations for Legendre's polynomials and Orthogonality for Legendre's polynomials. (3Hrs)
Legendre Fourier Series expansion. Relation between Laplace equation and Legendre equation. (4Hrs)

### MODULE III

Complex Integration, Cauchy's Integral theorem and its application. (4Hrs)
Integral formula for simply and multiply connected domains and its applications. (2Hrs)
Taylors and Laurents Series and their application. Singular points. (4hrs)

### MODULE IV

Liouvilles theorem with applications.Residue theorem and applications. (4 Hrs)
Contour Integration. Boundary value problems. (4Hrs)
Derivation and solution of one dimensional heat equation using separation of variable method. (2hrs)

**TEXT BOOKS:**


1. Engineering Mathematics by B.S.Grewal
2. Complex Variables and Its applications by Churchill and Brown


**REFERENCE BOOKS:**


1. Complex Analysis by Schaum Series
2. Special Functions by K.P.Gupta
3. Complex Variables (Theory and Applications): H.S.Kasana, PHI

## 4.2 SIGNALS AND SYSTEMS

### MODULE I

Introduction:
Definitions and concept of different types of signals; continuous time and discrete time signals; transformation of independent variable; exponent ional and sinusoidal signal; unit impulse and unit step functions. 5 hrs
Systems: continuous time and discrete time system and basic system properties. MATLAB programs. Linear time invariant (LTI) systems: Introduction: Discrete time LTI system; the convolution sum; continuous time LTI systems; the convolution integral; properties of LTI systems. MATLAB programs. 5 hrs

### MODULE II

Fourier series: introduction; response of LTI system to complex exponential; Fourier series representation of continuous-time periodic signals; convergence of the Fourier series; properties. 5 hours
Fourier series representation of discrete time periodic signals; properties of discrete- time Fourier series MATLAB programs. 5 hrs

### MODULE III

Continuous-time Fourier transform: Representation of periodic signals: Fourier transform of periodic signals and their properties; convolution property; multiplication property. MATLAB programs. 3 hrs
Discrete- time Fourier transform: Representation of a periodic signals; Fourier transform for periodic signals; properties; convolution property; multiplication property. 4 hrs

Sampling:
Introduction; representation of continuous time signals by its samples; sampling theorem; reconstruction of a signal from its samples using interpolation; the effects of under sampling; aliasing; Discrete-time processing of continuous-time signals; sampling of discrete- time signals; Mat lab exercises. 3 hrs

### MODULE IV

The Laplace transform: introduction; laplace transforms; the region of convergence; inverse lap lace transform; Analysis and characterization of LTI system using the laplace transform. Unilateral laplace transforms. MATLAB programs. 5 hrs

The Z-transform: introduction; Z-transform; the region of convergence; the inverse Z-transform; properties of Z-transform; analysis and characterization of LTI system using Z-transforms. 5 hrs

**TEXT BOOKS:**

1. Alan V Oppenheim,A.S.Willsky,Signals and systems,PHI

**REFERENCE BOOKS:**

1. Simon Haykins , Signals and Systems
2. Salivahanan s, Vallavaraj. A.and Gnanapriya c,Digital signal processing,Tata McGraw Hill
3. Nagrath, I.J.sharan,Rajan R.And Kumar,S, Signal and systems,Tata McGraw Hill
4. Ziemer,R.E.Trantor,W.H.and Fannin, D.R.Signal and Systems,Pearson education, Asia.

## 4.3 ELECTRICAL TECHNOLOGY

### MODULE I

DC generator: - Principle, types of generators and EMF equation. 2Hrs

DC motor:- Principle, voltage equation- illustrative examples, torque equation- illustrative examples, motor characteristics, speed control- illustrative examples, losses- illustrative examples, starters- three point starter. 4 Hrs

Three phase induction motors:- Principle, construction, slip- illustrative examples, starting torque- illustrative examples, torque under running condition- illustrative examples, torque slip characteristics, starting- illustrative examples and speed control. 4 Hrs

### MODULE II

Single phase induction motors: - working of resistance start, capacitor start, capacitor start capacitor run, permanent capacitor single phase induction motors. 3Hrs

Stepper motors: - operation of permanent magnet stepper motor, variable reluctance stepper motor, hybrid stepper motor. 2Hrs

Synchros: - construction, principle of operation. 2Hrs

Servomotor: - DC servomotor, Two phase AC servomotor. 1Hrs

Drives: - concept of an electric drives, four quadrant diagram of speed torque characteristics, classification and application of drives, braking of DC motors. 2 Hrs

### MODULE III

DC potentiometers: - Slide wire potentiometer- illustrative examples, Crompton's potentiometer, applications. 3Hrs

AC potentiometer: - Drysdale's polar potentiometer. 2Hrs

Electrodynamometer type wattmeter: - construction, operation, torque equation. 2Hrs

Energy meter: - construction, working, torque equation- illustrative examples. 2Hrs

Current transformer: - use of CT for current measurement, relationships in a CT- illustrative examples, errors. 1Hrs

### MODULE IV

AC bridges: - Maxwell's inductance bridge, Maxwell's inductance capacitance bridge, Hay's bridge, Owen's bridge, Schering's bridge, Wein's bridge-illustrative examples on all above mentioned bridges and Wagner's earthing device. 5Hrs

Illumination: - Definitions, Law of Inverse squares, Lambert's cosine law- illustrative examples. 2Hrs

Electric heating: - principle of resistance heating, high frequency eddy current heating, dielectric heating. 1Hrs

Introduction to power systems: - introduction to generation of electrical energy, hydal power plant, thermal power plant, nuclear power plant.

Typical AC electrical power system. 2 Hrs

**TEXT BOOKS:**


1. A textbook of electrical technology—B.L. Theraja (Vol II)
2. A Course in electrical and electronics measurements and instruments: - A.K.Sawhney.


**REFERENCE BOOKS:**


1. Electrical Power: - J.B.Gupta
2. A first course in Electrical Drives: - S.K. Pillai
3. A textbook of electrical technology:-B.L. Theraja (Vol I)

## 4.4 ELECTROMAGNETIC FIELDS AND WAVES

### MODULE I

**System of coordinates** : 3 Hrs

Cartesian, cylindrical and spherical coordinate system, transformation from cartesian to cylindrical and spherical coordinate system, transformation from cylindrical to spherical coordinates.

**Integration of scalar and vector functions** : 2 Hrs

Line integrals, surface integral, volume integral.

**Differentiation of scalar and vector functions** : 4 Hrs

Gradient of a scalar function, gradient in Cartesian, cylindrical and spherical coordinates.

Divergence of a vector field, divergence in Cartesian, cylindrical and spherical coordinates, Divergence theorem

Circulation of a vector field, Curl of a vector in Cartesian,cylindrical and spherical coordinates, Stoke's theorem.

Conservative and non-conservative fields, Helmholtz's theorem

**Electrostatics :** 1 Hrs

Coulomb's Law, Electric Field Intensity due to point charges and distributed charges.

### MODULE II

**Electrostatics :** 2 Hrs

Electric Flux density, Electric flux, Postulates of the electrostatic field, Gauss's law and its applications, Electric potential: Electrical potential due to point charges and distributed charges.

**Energy in electrostatic field** : 1 Hrs

Energy due to point and distributed charges.

**Boundary value problems** : 3 Hrs

Poisson's equations for the electrostatic field, Laplace's equation for the electrostatic field, Solution methods, Uniqueness theorem, Solution by direct integration, Solution by the method of Images.

**Interface Conditions** : 1 Hrs

Interface conditions between two dielectrics, Interface conditions between dielectrics and conductors.

**Capacitance** : 1 Hrs

Parallel plate capacitor, Capacitance of infinite structures.

**Conduction and Convection current density** : 2 Hrs

Convection current and convection current density, Conduction current and Conduction current density, Power dissipation and Joule's law, The continuity equation.

### MODULE III

**The Static Magnetic Field** : 3 Hrs

Magnetic Field, Magnetic Field Intensity, Magnetic Flux Density and Magnetic Flux, Postulates of static Magnetic field, Magnetic Vector potential, Magnetic Scalar potential, Magnetic Dipole

Biot Savart Law, Ampere's circuital Law.

Behaviour of Magnetic Materials, Diamagnetic and Ferromagnetic materials.

**Magnetic circuits** : 1 Hrs

Magnetomotive force, Magnetic reluctance, Forces in the magnetic field.

**Energy stored in the magnetic field**: 1Hrs

Magnetostatic energy in terms of fields.

**Time varying Electric and Magnetic fields** : 2 Hrs

Faraday's Law, Lenz's Law, Electromotive force, Eddy currents.

**Maxwell's Equations** : 2 Hrs

Continuity equation for time varying fields, Displacement current density, Generalized Ampere's Law, Maxwell's equations in differential, integral and time harmonic representation.

**Interface conditions for Electromagnetic Field** : 1 Hrs

Interface condition for the electric field, interface condition for the magnetic field.

## MODULE IV

**Electromagnetic wave equation and its solution**: 2 Hrs

Electromagnetic waves, Time dependent wave equation, Time Harmonic Wave Equation, Solution of the wave equation for uniform plane waves in free space , perfect dielectrics.

**Poynting's Theorem:** 2 Hrs

Poynting vector, Complex Poynting vector, Electromagnetic power density.

**Propagation of Plane waves in Materials** : 1 Hrs

Propagation of plane waves in lossy dielectrics, low loss dielectrics and conductors, Concept of Phase and Group velocity.

**Polarization of Plane Waves** : 2 Hrs

Concept of Polarization, Linear, Elliptical and Circular Polarization

**Reflection and Transmission of Plane Waves** : 3 Hrs

Reflection and Transmission at a General Dielectric Interface with Normal Incidence, Standing Waves, Oblique incidence on a conducting surface with perpendicular polarization and parallel polarization, Brewster's Angle, Total Internal Reflection.

**Text books :**


1. Engineering Electromagnetics by Nathan Ida, 2nd Edition, Springer International Edition.
2. Elements of Electromagnetics by Mathew Sadiku, 4th edition, Oxford University Press.


**Reference Books :**


1. Electromagnetics by John D. Kraus,5th Edition, Mcgraw Hill.
2. Theory and Problems in Electromagnetcs by Joseph Edminister, Schaum Series, McGraw Hill
3. Field and Wave Electromagnetics by David K. Cheng, Second Edition, Pearson Education
4. Engineering Electromagnetics by William H. Hayt and John A. Buck, Seventh Edition, Tata McGraw Hill Edition.

## 4.5 LINEAR INTEGRATED CIRCUITS

### MODULE I

Differential Amplifiers (4 types), Derivations, FET diff. amp, constant current bias, current mirror 2Hrs
Op- amps parameters, definitions, Measurements, offset compensation, Functional block diagrams and working specification of IC741, equivalent circuit of Op-amp and transfer curve 2Hrs
Feedback in op-Amp, Frequency response and methods of frequency compensation 1Hrs
Applications of Operational amplifiers (linear amplifiers and filters , Inverting and non inverting amplifiers, Ac & DC Differentiator, Integrator, summing & difference amplifier. 2Hrs
Instrumentation amplifier, voltage follower, V-I & I-V converter,Precision rectifier, Log and antilog amplifier 2Hrs
Design of Active filters such as Butterworth low pass, high pass, band pass, notch filters 1Hrs

### MODULE-II

Op-Amps as Comparators, zero crossing detectors, Schmitt trigger, ramp generators, Triangular wave generator. 2Hrs
Analysis of the waveform with SPICE 1Hrs
Oscillators : wein bridge oscillator, phase shift oscillators , design & problems 2Hrs
Voltage regulators.Specifications, functional block diagrams of IC 723, Design of IC 723 as high & low voltage regulators 2Hrs
Specifications, functional block diagrams of IC LH 105 1Hrs
Three terminal regulator IC78XX, 79XX, LM309, LM317, voltage regulator and tracking regulator. 1Hrs
Principles and working of switching mode regulators, applications of switching regulator IC 78540, Universal Switching regulator 1Hrs

### MODULE III

Introduction to resolution & accuracy in convertors, quantization error, sample & hold circuit 1Hrs
ADC and DAC: A/D and D/A conversion principles, principle of successive approximation, successive approximation ADC, binary weighted resistors & R-2R resistor ladder (Design & problems) 3 Hrs
Specifications, functional block diagrams, applications of 0809 & 0808 1 Hrs
Phase- Locked loop(PLL)
Basic principles of phase-locked loop and block diagram 1 Hrs
Transfer characteristics of PLL, Lock Range, and Capture range. 1 Hrs
Applications of PLL as frequency multiplier, AM Demodulation, FM demodulation, 2 Hrs
Study of PLL IC 565 and its applications design 1 Hrs

### MODULE IV

Op-Amps as bistable, monostable and astable multivibrator 2 Hrs
IC 555: Functional block diagram and specification, Modes of IC555 1Hrs
Applications of IC555 as monostable & astable multivibrator (design) 2Hrs
IC 555: Application as VCO, missing pulse detector, frequency divider, ramp generator, PWM 2 Hrs
Waveforms generating ICs:
Study of IC566, IC 8038 and IC XR2206 and their applications in waveforms generations 3 Hrs

**Text Books :**


1. Ramakant Gayakwad, Op-Amps and linear integrated circuits, Prentice Hall of India Pvt. Ltd.
2. Botkar, K.R. Integrated Circuits, Khanna Pub.
3. SPICE by Gorden W. Roberts & Adel Sedra, Oxford


**Reference Books:**


1. Millman And Halkias, integrated electronics: Analog and digital circuits system McGraw Hill Pub.
2. Sergio Franco, Design with operational amplifiers and analog integrated circuits, McGraw Hill.
3. Modern Digital Electronics by R. P. Jain, TMH
4. SPICE by Circuits & Electronics using Pspice by Muhamad H. Rassid, PHI

## 4.6 DATA STRUCTURES USING C++

### MODULE I

Object Oriented Programming: Basic concepts and benefits of OOP, Basic, User defined and derived data types. 2hrs

Reference variables, Arithmetic and logical operators, scope resolution and memory management operators. Expressions and control structures. 4hrs

Functions in C++, Classes & Objects, Constructors & Destructors. 4hrs

### MODULE II

Operator Overloading: Definition, Overloading unary and binary operators, manipulation of strings. 4hrs

Inheritance: derived classes, Types of inheritance, constructors in derived classes, nesting of classes. 3hrs

Pointers: pointers to objects, this pointer, pointers to derived classes. Virtual functions, Templates: Class templates & Function templates. 3hrs

### MODULE III

Linked list: Single, Doubly, Circular linked lists. Stacks: as an array and linked list, applications of stacks. 4hrs

Queues: as an array and linked list, Circular, deque. 4hrs

Trees: Traversal of binary tree, BST, operations on BST, Reconstruction of Binary tree.
Heap. 3hrs

### MODULE IV

Graphs: Definitions and Terminology, DFS & BFS, Spanning Tree. 4hrs

Searching: Linear search, Binary search. 2hrs

Sorting: Bubble sort, selection sort, Quick sort, Insertion sort, Merge sort, Heap sort, Binary Tree sort. 4hrs

**Text Books:**

1. Object Oriented Programming with C++ by E. Balagurusamy.
2. Data Structures through C++ by Yeshwant Kanetkar
3. Let Us C++ by Yeshwant Kanetkar

**Reference Books:**

1. Object Oriented Programming in Turbo C++ by Robert Lafore
2. Schaum Series Programming with C++ by John Hubbard
3. Programming with C++ by Ravichandran
4. C++ Primer by Lippman and Lajoie.
5. Mastering C++ by Venugopal, Rajkumar, Ravishankar
6. Data Structures using C++ by Tenenbaum.

# GOA UNIVERSITY

## THIRD YEAR OF BACHELOR'S DEGREE COURSE IN ELECTRONICS AND TELECOMMUNICATION ENGINEERING

## (REVISED COURSE-2007)

## SCHEME OF INSTRUCTION AND EXAMINATION

**SEMESTERV,**

| Sub code | Subjects | Scheme Of Instruction Hrs/Week | | | Scheme Of Examination | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Th. Dur (Hrs) | Marks | | | | |
| | | L | T | P | | Th. | S | P | O | Total |
| 5.1 | Probability Theory and Random Processes | 4 | 0 | - | 3 | 100 | 25 | - | - | 125 |
| 5.2 | Control System Engineering | 4 | 0 | 2 | 3 | 100 | 25 | - | - | 125 |
| 5.3 | Communication Engineering-I | 4 | 0 | 2 | 3 | 100 | 25 | - | 50 | 175 |
| 5.4 | Microprocessors | 4 | 0 | 2 | 3 | 100 | 25 | - | 50 | 175 |
| 5.5 | Digital Signal Processing | 4 | 0 | 2 | 3 | 100 | 25 | - | - | 125 |
| 5.6 | Transmission Lines and Waveguides | 4 | 0 | - | 3 | 100 | 25 | - | - | 125 |
| | **Total** | **24** | **0** | **8** | | **600** | **150** | | **100** | **850** |

**SEMESTER VI,**

| Sub code | Subjects | Scheme Of Instruction Hrs/Week | | | Scheme Of Examination | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Th. Dur (Hrs) | Marks | | | | |
| | | L | T | P | | Th. | S | P | O | Total |
| 6.1 | Communication Engineering-II | 4 | 0 | 0 | 3 | 100 | 25 | - | 50 | 175 |
| 6.2 | Peripheral Devices and Interfacing | 4 | 0 | 2 | 3 | 100 | 25 | - | - | 125 |
| 6.3 | Power Electronics | 4 | 0 | 2 | 3 | 100 | 25 | - | - | 125 |
| 6.4 | Antenna and Wave Propagation | 4 | 0 | - | 3 | 100 | 25 | - | - | 125 |
| 6.5 | Electronic Instrumentation | 4 | 0 | 2 | 3 | 100 | 25 | - | - | 125 |
| 6.6 | VLSI Technology and Design | 4 | 0 | 2 | 3 | 100 | 25 | - | 50 | 175 |
| | **Total** | **24** | **0** | **8** | | **600** | **150** | | **100** | **850** |

L – Lectures, T-Tutorials, P-Practicals. Th. Dur. – Duration of Theory Paper
Th – Theory, S – Sessional, P– Practical, O – Oral.

# ETC 5.1: Probability Theory and Random Processes

## Course objectives: (Module-wise):

## Module 1:

To teach basics of probability and probability distributions; Random variables and their distributions, their expectations and variance

## Module 2:

To teach 2-D Random variables and their distributions, independence, covariance, correlation, computation of probabilities and expectation.

## Module 3:

To teach sampling distributions, tests of hypothesis and significance, Analysis of variance.

## Module 4:

To introduce state space, stochastic processes, Auto-Correlation, Cross Correlation, auto-covariance, cross-covariance with details study of Markov Chains and Poisson processes.

## Instructional Objectives:

- To familiarize the students with the concept of probability, random variables and their distribution with emphasis on stochastic processes.
- The concepts so gained will be useful in understanding future subjects such as: Digital Communication, Data Communication, Mobile Communication, Adaptive Signal Processing, Statistical theory of Communication, etc.

# ETC 5.1: Probability Theory and Random Processes

### Module 1

### Introduction to Probability Theory and Random Variables

Introduction - Sample Space and Events, Probabilities defined on Events, Conditional Probabilities, Independent Events, Total Probability Theorem, Bayes' Theorem and its Applications. **(2 hours )**

Random Variables, Discrete and Continuous Random Variables, Probability Distribution, Expectation, Variance, Cumulative Distribution Function,

Moment Generating Function, Functions of a Random Rariable and their Distribution, Expectation and Variance of functions of a random variable. **( 4 hours)**

Some Important Probability Distributions and their Mean, Variance and Moments – Bernoulli Distribution, Binomial Distribution, Geometric Distribution Poisson Distribution, Uniform Distribution, Exponential Distribution, Gamma Distribution and Normal Distribution. **( 4 hours)**

## Module 2

### Higher Dimensional Random Variables

Introduction, Discrete and Continuous Two Dimensional Random Variables- Joint Probability Distribution, Marginal Distributions, Independence of Random Variables, Covariance and Correlation, Uncorrelated Random Variables. **( 5 hours)**

Real Valued Functions of Two Dimensional Random Variables and their Probability Distributions, Conditional Probability Distribution and Conditional Expectation, Computing Probabilities and Expectations by Conditioning, Moment Generating Function of Sums of Independent Random Variables. **(5 hours)**

## Module 3

### Tests of Hypotheses and Analysis of Variance (ANOVA)

Sampling Theory, Random Samples, Sampling Distributions, Statistical Decisions and Statistical Hypotheses, Tests of Hypothesis and Significance, Level of Significance, One-Sided and Two-sided Hypotheses, Two-Tailed and One-Tailed Tests. **( 1 hour)**

Tests of Hypothesis for Large samples – Tests of hypotheses on the Mean, Tests of Hypothesis on the equality of Two Means, Tests of Hypothesis on a Proportion, Tests of Hypothesis on the Equality of Two Proportions, Tests of Hypothesis on a Standard Deviation, Tests of Hypothesis on the Equality of Two Standard Deviations. **( 2 hours)**

Tests of Hypotheses for Small Samples – Test of Hypothesis on the Mean for a Normally Distributed Population, Tests of Hypothesis on the equality of Two Means for Normally Distributed Populations, Tests of Hypothesis on the Variance of a Normally Distributed Population, Tests of Hypothesis on Equality of Variances of two Normally Distributed Populations, Testing for Goodness of Fit, Tests for Independence of Attributes. **(6 hours)**

Analysis of Variance (ANOVA) – One-Way and Two- Way Classification Analysis of Variance. **(1 hour)**

## Module 4

### Stochastic Processes

Introduction, State Space, Higher Order Joint Distributions of a Stochastic Process, Independence of a Stochastic Process, Auto– Correlation Function, Auto – Covariance, Correlation Coefficient, Cross- Correlation Function, Cross-Covariance, Cross- Correlation Coefficient, Strict Sense Stationary Process, Wide Sense Stationary Process, Jointly Wide Sense Stationary Process, Evolutionary Process, Ergodicity in Mean and Auto - Correlation Function. **( 3 hours)**

Markov Chains – Introduction, Transition Probabilities, Homogeneous Markov Chains, One-Step and n-Step Transition Probability Matrix , Initial Distribution, Probability Mass Function of the Random Variables of a Markov Chain, Joint Distribution of a Markov Chain, Chapman-Kolmogorov Equations, Absorbing States, Communication between States, Irreducible Markov Chains, Steady State Vector. **( 5 hours)**

Poisson Processes – Introduction, Counting processes, Definition of Poisson Process, Sum of Two Independent Poisson Processes, Inter-Arrival and Waiting Time Distributions for a Poisson Process, Applications of Poisson Processes. **(2 hours)**

## Text books


1. A first Course in Probability, Sixth Edition, Pearson Education, by Sheldon Ross.

2. Probability and Statistics in Engineering by William W. Hines, Douglas C. Montgomery, David M. Goldsman, and Connie M. Borror .

3. Probability, Statistics and Random Processes, Second Edition, Tata McGraw-Hill, by T. Veerajan


**Recommended Books**


1. Probability and Statistics with Reliability, Queuing and Computer Science Applications, Prentice Hall, by Kishor S. Trivedi.
2. Statistics, Third Edition, Schaum's Outlines, by Murray R. Spiegel and Harry J. Stephens.

3. Introduction to Probability Models, Seventh Edition, Academic Press, by Sheldon Ross

## ETC 5.2 Control System Engineering

### Course Objective: (Module-wise)

**Module 1:** To introduce basic control system components, signal flow graphs and transfer functions.

**Module 2:**

- To teach about to transient response of systems.
- To introduce concept stability.

**Module 3:** To introduce frequency-domain analysis of system response.

**Module 4:**

- To teach about the design of compensators in frequency-domain to improve the system performance.
- To introduce digital control systems.

**Instructional Objectives:**

- To teach classical control system analysis and design and introduce basics of digital control systems.
- Making the students imbibe the concepts of time-domain analysis and frequency-domain analysis.
- To introduce modeling and analytical solutions to control system problems.

## ETC 5.2: CONTROL SYSTEM ENGINEERING

### MODULE 1

Introduction to control systems; types of control systems, basic concept of open-loop and closed-loop control systems; 1Hour

Mathematical modeling and representation of mechanical (translational & rotational) and electrical systems; 3Hours

Conversion of mechanical to analogous electrical systems (force-voltage and force-current analogy); 1Hours

Block diagrams, 3Hours

Signal flow graphs and transfer functions. 2Hours

## MODULE 2

Transient response of first and second order systems; 3Hours

Type -0, -1 and –2. control systems; Steady state error and error co-efficient; 3Hours

Stability concept, Routh-Hurwitz criteria; 2Hours

Stability under parameter uncertainty: robust control; 2Hours

root-locus techniques. 3Hours

## MODULE 3

Frequency-domain analysis, polar-plots, 2Hours

Bode-plots, 4Hours

Nyquist-plots; Relative stability using Nyquist-plot. 4Hours

## MODULE 4

Concept of compensators; types of compensators; 1Hour

Design of Cascade compensator in time domain- Lead, Lag and Lead-Lag compensation 3Hours

Design of Cascade compensator in frequency domain -Lead, Lag and Lead-Lag compensation 4Hours

Introduction to digital control system, discrete time system, sampled data and digital control system-digital Vs analog controller, sampling process. 2Hours

TEXT BOOKS:

Control Systems-Principles and Design - M. Gopal, Tata Mc Graw Hill

1. Control Systems Engineering,– I.J. Nagrath and M. Gopal, The New Age International (P) Ltd., New Delhi
2. Modern Control Engineering—D. Roy Choudhry

REFERENCE BOOKS:

1. Modern Control Engineering, -K.Ogala, PHI
2. Control Systems, -A.Nagoor Kani, RBA Publications, Chennai
3. Automatic Control Systems, - B.C.Kuo ,PHI

# ETC 5.3: Communication Engineering - I

**Course objectives: (Module-wise):**

**Module 1:**

To teach the fundamentals of analog modulation and detection techniques.

**Module 2:**

To teach about transmission and reception of signals and noise. A brief introduction of pulse modulation is to be given.

**Module 3:**

To teach about correlation and sampling of signals and cover the Pulse Code Modulation in details.

***Module 4:***

To teach the digital modulation techniques and multiplexing.

**Instructional Objectives:**

- To teach the analog modulation (which includes Pulse Modulation) and Digital Modulation techniques in detail, this being the first course in communication. However, more emphasis shall be given to digital modulation techniques.

## ETC 5.3: COMMUNICATION ENGINEERING-I

### MODULE 1

Need for modulation. Principles of AM, Frequency spectrum of AM wave, AM power and current relationship, modulation by multiple sine waves.
Generation of AM: Modulated transistor amplifier. AM Detection – Diode Detector

(3 Hrs)

DSB-SC Techniques, Suppression of carrier, Effect of non-linear resistance on added signals (Square law modulator), Balance modulator

Methods of generation of SSB -Filter systems, phase shift method & third method. Comparison of various methods. (3 hrs)

Principles of FM and PM, Mathematical representation, Spectrum, Narrowband and wideband FM, power contents of carrier and sideband. Effects of noise in FM. (2 hrs)

FM generation methods: Direct method, Armstrong method, Slope Detector, Foster-Seelay discriminator, Ratio detector. (2hrs)

### MODULE 2

AM and FM transmitter, TRF receivers, super heterodyne receivers, solidstate circuits for RF-amplifiers, Mixer, IF amplifier, AGC, AFC, Amplitude limiter, Pre-emphasis, De-emphasis, Audio muting. (4hrs)

Noise- various noise sources, Noise calculations for – single noise sources, multiple noise sources, cascade amplifiers. Noise figure , Noise temperature, Equivalent input noise resistance. (4 hrs)

Pulse Modulation: Introduction, PAM, PWM, PPM. Generation and detection. (2 hrs)

### MODULE 3

Correlation: Correlation between waveforms, Cross-correlation, Autocorrelation, Autocorrelation of a periodic waveform, autocorrelation of a non-periodic waveform of finite energy, autocorrelation of other waveforms (2 hours)
Sampling: Sampling theorem, Natural Sampling, Flat top sampling, recovery through holding. (2 hours)
Quantization: Quantization of signals, Midrise and Midtread Quantizers, Quantization error. (1 hour)
Pulse Code Modulation: Pulse Code Modulation, Electrical representation of binary digits, PCM system, Companding, μ Law and A Law Companders, Differential Pulse

Code Modulation (DPCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM)
(5 hours)

## MODULE 4

Multiplexing: Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM) (1 hours)

Digital Modulation Techniques: Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Differentially Encoded PSK( DEPSK),
(4 hrs)

Quadrature Phase Shift Keying (QPSK), M-ary PSK, Minimum Shift Keying (MSK), Gaussian MSK, Quadrature Amplitude Shift Keying( QASK), Binary Frequency Shift Keying(BFSK), Comparison of digital modulation techniques.
(5hours)

TEXT BOOK


1. Electronic Communication System – George Kennedy- Tata McGraw Hill
2. Principles of Communication Systems by Taub, Schilling, Saha, Third Edition, Tata McGraw Hill Publishing Company.,


BOOKS RECOMMENDED:


1. Modern Digital and Analog Communication Systems - B.P. Lathi 3rd edition - OXFORD University Press
2. Electronic Communication System – Dennis Roddy and John Coolen- PHI
3. Electronic communications Systems-Wayne Tomasi, Pearson Education, 3rd edition
4. Digital Communications by John Proakis, 4th Edition, McGraw Hill International
5. Communication Systems : Analog & Digital by Singh & Sapre, Tata McGraw Hill Publishing Company
6. Digital Communications : Fundamental & Applications by Bernard Sklar, Second Edition, Pearson Education

# ETC 5.4 MICROPROCESSORS

**Course objectives (module-wise):**

**Module 1 :** -To teach all aspects of 8085 Microprocessor and introducing the basic concepts of programming, the block diagrams instructions and timing diagrams.

**Module 2 :** -To teach about the organization, memory, operating modes, timing, instruction set and programming of 8086 microprocessor.

**Module 3 :** -To teach about the Logical and string control instructions, flag manipulation instructions, assemblers, stack and macros and related programming.

**Module 4 :** -To teach about 8086 interrupts, Multiprocessor systems, Numeric processor 8087, I/O processor 8089 and Intel processors (from 80186 to Pentium).

**Instructional Objectives:**

-To teach the Architecture, Programming and applications of microprocessors 8085, 8086, 8087, 8089 with emphasis on interfacing and programming.

# ETC 5.4: MICROPROCESSORS

## MODULE 1

Introduction to microprocessors, block diagram of microprocessor, difference between microprocessor & microcontroller, CISC & RISC processors, different ways of programming: machine, assembly & high level language, (2)

8085 Microprocessor: pin out and signal description, (1)

architecture, demultiplexing Address/Data bus, Generating Control Signals, (2)

addressing modes, (1)

timing diagrams for Opcode Fetch, memory read and write signals , (1)

stack organization ( stack ,push & pop instructions with example) , (1)

interrupts (types, priorities), (1)

overview of instruction set (classification of instruction set),

limitations of 8085,introduction to 8086, comparision between 8085 & 8086 . (1)

**MODULE 2**

8086 Microprocessor: Register organization, pipelining, (1)

architecture, (1)

physical memory organization, (1)

pin out & signal description, (1)

operating modes of 8086 and timings, (1)

Addressing modes of 8086, (1)

Calculation of physical address, constructing machine codes for

instructions (2)

data transfer , arithmetic instructions & related programming (2)

**MODULE 3**

8086 Microprocessor:Logical, string control instructions & related programming, (2)

Machine control, conditional, unconditional, flag manipulation instructions

& related programming , (2)

Assembler directives, (1)

Writing programs using assembler (1)

Stack, macros & related programming, (2)

Procedures. (2)

**MODULE 4**

8086 Interrupts, related programming, (2)

Multiprocessing systems: Software aspects of multiprocessor systems, (1)

Numeric processor 8087: architecture, signal description, register set, exception handling, interconnection of 8087 with CPU ,communication with CPU , (3)

I/O processors 8089: Architecture, communication with CPU, bus arbitration and Control, arbitration schemes, (3)

Comparison of features of Intel Processors: from 80186 to Pentium . (1)

TEXTBOOKS:


1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, Penram International Publishing (India).
2. Microprocessors and Interfacing programming and Hardware-Douglas V. Hall


REFERENCE BOOKS:


1. Advanced Microprocessors and Peripherals –A .K. Ray and K. M. Bhurchandi
2. Introduction to microprocessor, Aditya Mathur, Tata McGraw hill.
3. Microprocessor and Microcomputer based System Design, Rafiquzzaman, USB, New Delhi.
4. Microprocessors and Microcomputers, B. Ram, Tata McGraw Hill.
5. Microcomputer Systems The 8086 /8088 family Architecture, Programming and Design-Yu-Cheng Liu and Glenn A. Gibbon
6. Advanced Microprocessors and Interfacing –Badri Ram

# ETC 5.5 – Digital Signal Processing

**Course Objectives (Module-wise):**

**Module 1 :** To teach the applications of Fourier Transform to discrete-time signals and FFT algorithms.

**Module 2 :** To teach the realization of discrete-time systems.
To teach the design of IIR digital filters.

**Module 3 :** To teach the design of Linear phase FIR filters.
To introduce multi-rate signal processing and its applications.

**Module 4 :** To teach the architecture of Digital Signal processors.

**Instructional Objectives :**

To introduce students to discrete-time signal processing, digital filtering, multi-rate signal processing and architecture of Digital Signal processors.
To prepare the students to pursue such exotic electives as Adaptive signal processing, Speech process processing, Image processing, Computer vision, Smart Antennas.

## ETC 5.5 DIGITAL SIGNAL PROCESSING

MODULE I

Discrete-Time signal and its application to LTI system Discrete-Time Fourier transform (DTFT), Discrete Fourier Transform (DFT), Relationship between the DTFT and DFT and their inverses - ( 2hrs)
DFT properties, Linear and circular convolution, Linear filtering methods based on DFT. (2 Hrs)

Efficient computation of DFT: Fast Fourier transform [F.F.T] direct computation of DFT, Divide and conquer approach of DFT- (2 Hrs)
Radix-2 FFT algorithm: Decimation in Time [D.I.T] and Decimation in frequency [D.I.F] , Shuffling of the data and bit reversal (4 Hrs)

MODULE 2

Realisation of Discrete Time System -introduction, Basic Realisation block diagram and the signal flow graph, Basic structures of IIR filter: Direct, canonical, cascade and parallel realizations. (2 Hrs)

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filters. (2 Hrs)

Design of IIR filter: IIR filter design by impulse invariance, bilinear transformation, Butter worth filter, Chebyshev filters (6 Hrs)

MODULE 3

Design of FIR filters: Linear phase FIR systems. Symmetric FIR Filters, design of linear phase-FIR filters using windows (Rectangular, Hann, Hamming, Kaiser), frequency sampling method. (4 Hrs)

Multirate Digital Signal Processing : Introduction, Decimation by factor D, Interpolation by factor I, sampling, sampling rate conversion by rational factor I/D - (4 hrs)

Application of Multirate signal processing, Design of Phase shifters, interfacing of digital systems with different sampling rates, Subband coding of speech signals.- (2 Hrs)

MODULE 4

Introduction to programmable Digital signal processors: Multiplier and Multiplier Accumulator (MAC), modified bus structure and memory access schemes, pipelining, special addressing modes, on–chip peripherals.

Architecture of TMS320C5X-Introduction, bus structure, central arithmetic logic unit(CALU), registers, flags, on-chip memory, on-chip peripherals

**TEXT BOOKS**:

Digital Signal Processing, Algorithm and Applications: John C. Proakis & Dimitries G. Manolakis, PHI
Digital signal processors architecture, programming and applications: B Venkataramani M Bhaskar,Tata McGrawHill

**REFERENCE BOOKS:**

Digital Signal Processing: Salivahanan
Signal Processing & Linear systems: B.P.Lathi, Oxford
Understanding Digital Signal Processing: Lyons, Addison Wesseley
Theory and Application of Digital Signal Processing: Rabiner and Gold, PHI
Introduction to Digital Signal Processing: Johny R. Johnson,PHI
Discrete Signal Processing: Oppenheim & Schaffer, PHI

# ETC 5.6 –Transmission Lines and Waveguides

**Course Objectives (Module-wise):**

**Module 1 :** To study the general solution of a transmission-line under various terminal conditions.

**Module 2 :** To study a transmission line at radio frequency, matching of the line under different loads.
To study dissipationless lines.

**Module 3 :** To study single-stub and double-stub matching on a line.
To acquaint the students with Smith chart.

**Module 4 :** To study guided-waves.
To teach propagation in waveguides.

**Instructional Objectives:**

To acquaint the students with all aspects of guided-wave propagation over transmission lines and wave-guide structures.
To enable the students to integrate their learning seamlessly with what they learned from "Electromagnetic Waves and Fields" in semester IV and also with what they are going to learn in "Antenna and Wave Propagation' in VI semester, the three forming a trilogy of field subjects.

# ETC 5.6 –Transmission Lines and Waveguides

## MODULE 1

Transmission-Line Theory: A line of cascaded T-sections (line constants: Z, Y, characteristic impedance Zo, propagation constant $\gamma$); The transmission line-general solution; Physical significance of the equations; the infinite line. (3hrs)

Wavelength; velocity of propagation; Waveform Distortion; The distortionless line. (2hrs)

Reflection on a line not terminated in Zo (Voltage and current-phasors, Energy view point of Reflection); Reflection coefficient. (3hrs)

Input and transfer impedance; Open- and short-circuited lines. (2hrs)

## MODULE 2

The Line At Radio Frequencies : Introduction; Constants for the line of zero dissipation (Lossless Lines); Voltages and currents on the dissipationless line (Voltage and Current phasors on the line for various terminations); Standing waves; nodes; standing wave ratio (SWR);Directional Coupler.

(3hrs)

Input-impedance of the dissipationless line; Input impedance of open- and short-circuited lines.

(3hrs)

Power and Impedance measurement on lines; Reflection losses on the unmatched line.(2hrs)

The eighth- wave line; The quarter-wave line; impedance matching; The half-wave line. (2hrs)

**MODULE 3**

Single-stub impedance matching on a line; The Smith circle diagram. (3hrs)

Applications of the Smith chart; Single-stub matching with the Smith chart; Double-stub impedance matching on a line. (4hrs)
.

Lines of small Dissipation: Constants for the line of "small" dissipation; Voltages and currents on the line of small dissipation; Open- and short-circuit impedances when considering dissipation; Quarter- and half-wave lines of small dissipation. (3hrs)

**MODULE 4**

Guided waves: Waves between parallel planes; Transverse electric(TE) waves; Transverse magnetic (TM) waves; Characteristics of TE and TM waves; Transverse electromagnetic (TEM) waves; Velocities of propagation. . (3hrs)

Wave Guides: Rectangular guides; Transverse magnetic waves in rectangular guides; Transverse electric waves in rectangular guides (field configurations of TE and TM waves in rectangular guides); Excitation methods for various modes; Impossibility of TEM wave in waveguides.

(4hrs)
Wave impedances (for rectangular guides); Transmission- line analogy for wave guides; Wave-guide discontinuities. .
(3hrs)

Text Books:


1. Networks, Lines and Fields by J.D. Ryder, PHI.
2. Electromagnetic Waves & Radiating Systems by E.C. Jordan and K. G. Balmain, PHI.


Reference Books:


1. Electronic Communication Systems,3rd Edition, Tata McGraw Hill by George Kennedy.
2. Fields and Waves in Communication Circuits, Ramo & Whinnery, John , Wiley & Sons.

# ETC 6.1: Communication Engineering - II

**Course objectives: (Module-wise):**

**Module 1:**

To teach about the basics of Information Theory and coding and the optimum digital reception.

**Module 2:**

To teach about various coding methods and their comparison.

**Module 3:**

To teach prepare students for topics in advanced communication, namely, spread spectrum and Mobile communication.

**Module 4:**

To give an introduction to Telephony, switching techniques and traffic engineering.

**Instructional Objectives:**

- To emphasize the reliability and efficiency achieved in Digital communication vis-à-vis analog communication. In addition students shall be introduced to wireless communication.

# ETC 6.1 COMMUNICATION ENGINEERING – II

## MODULE 1

**Optimal Reception of Digital Signal :**

A Baseband Signal Receiver: Peak Signal to RMS Noise Output Voltage Ratio, Probability of Error, Optimum Threshold : Maximum Likelihood Detector and Bayes Receiver. (1 hour)

Optimum Receiver for both Baseband and Passband ::Calculation of Optimum Filter transfer Function, Optimum Filter Realization using Matched Filter, Probability of Error of the Matched Filter, Optimum Filter realization using Correlator ( 2 hours)

**Information Theory:**

Discrete messages and information content: The Concept of amount of Information, Average Information, Entropy, Information rate.
(1 hour)
Source Coding to increase average information per bit: Shannon Fano Coding, Huffman Coding, Lempel Ziv Coding.
(2 hours)
Shannon's Theorem and Channel capacity: Capacity of a Gaussian Channel, Bandwidth S/N tradeoff.
(1 hour)
Use of orthogonal signals to attain Shannon's limit: Orthogonal Signals, Matched Filter reception, Calculation of Error Probability, Efficiency of Orthogonal transmission, Shannon Limit.
(2 hour)
Mutual Information and Channel Capacity, Rate Distortion Theory and Lossy Source Coding.
(1 hour)

## MODULE II

**Coding :**

Coding : Introduction, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check bit for error detection, Coding for Error detection and correction, Block Codes, Hamming distance.
(2 hours)
Upper Bound of the Probability of error with Coding, Hard Decision Coding.
Block Codes : Coding and Decoding, Decoding the received Code Word. ( 1 hour)
Hadamard , Hamming, Cyclic, BCH and other Algebraic Codes: Single Parity Check Bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Golay Code, BCH Codes.
( 1 hour)
Burst Error Correction : Block interleaving, Convolutional Interleaving, Reed Solomon Code, Concatenated Codes.
( 1 hour)
Convolutional Coding : Code Generation, Decoding Convolutional Code : The Code Tree, decoding in the presence of Noise, Sequential Decoding, State and Trellis Diagrams, The Viterbi Algorithm.
( 2 hours)
Comparison of Error rates in Coded and Uncoded Transmission, Turbo Codes, Automatic Repeat Request, Performance of ARQ Systems. ( 1 hour)
An Application of Information Theory : An Optimum Modulation System, Comparison of Amplitude Modulation System with Optimum System, A Comparison of FM Systems, Comparison of PCM and FM Communication Systems. (1 hour)

Feedback Communication : System description, Calculation of Average Transmitted Signal Energy per bit, Comparison of Information Rate with Channel capacity.
Trellis Decoded Modulation (
1 hour)

## MODULE III

**Spread Spectrum Modulation :**

Use of Spread Spectrum
Direct Sequence (DS) Spread Spectrum: Effect of Thermal Noise, Single Tone interference and Jamming.
(2 hours)
Spread Spectrum and Code Division Multiple Access, Multipath Fading and its avoidance. Ranging using DS Spread Spectrum
( 2 hour)
Frequency Hopping (FH) Spread Spectrum : The Need for Coding, The Near Far Problem, Spectrum of FH Spread Spectrum, Detection of FH/BFSK Signal.
( 1 hour)
Pseudo random Sequences : Generation and characteristics, Sequence Length, Independence of Sequences, Number of ones and zeros in a maximal sequence, Clustering in a PN Sequence, Properties of Shifted Sequences, Autocorrelation of a PN Sequence, Power Spectral Density.
( 2
hours)
Synchronization in Spread Spectrum Systems: Acquisition of an FH Signal, Tracking of an FH Signal, Acquisition of a DS Signal, Tracking of a DS Signal
( 1 hour)
Mobile Telephone Communication : The Cellular Concept, Call Setup in Mobile Communication, Mobile to Mobile Communication, Mobile to Mobile Calls, Mobile to Fixed Subscriber Calls, Digital Cellular Phone Systems : TDMA/GSM, CDMA/CDMAONE, Global Positioning System.
(1 hour)
Application of Phase Locked Loops : Carrier Recovery, Clock Recovery, Frequency Synthesis, Phase and Frequency Modulation
( 1 hour)

## MODULE IV

**TELECOMMUNICATION SWITCHING SYSTEMS**

Switching Systems : Classification of switching systems, simple telephone communication, Basics of a switching system, Signaling tones, Principle of common control, touch tone dial telephone, Centralized SPC and Distributed SPC.
(4 hours)
Time Division Switching : Basic Time Division Space Switching, Basic Time division time switching, Time multiplexed Space Switching, Time multiplexed time switching.

(3 hours)

Traffic Engineering : Network Traffic Load & Parameters, Grade of Service & Blocking Probability, Incoming traffic & Service time characterization. (2 hours)

Numbering Plan, Common Channel Signaling ( 1 hour)

**TEXT BOOKS :**

(1) Principles of Communication Systems by Taub, Schilling, Saha, Third Edition, Tata McGraw Hill Publishing Company.,

(2) Telecommunication Switching Systems & Networks by K Vishwanathan, Prentice Hall of India.

**REFERENCE BOOKS :**


1. Digital Communications by John Proakis, 4th Edition, McGraw Hill International
2. Communication Systems : Analog & Digital by Singh & Sapre, Tata McGraw Hill Publishing Company
3. Digital Communications : Fundamental & Applications by Bernard Sklar, Second Edition, Pearson Education
4. Digital Modulation & Coding by Stephen Wilson, Pearson Education
5. Communication Systems by Simon Haykins, 3rd edition, John Wiley & Sons.
6. Information Theory, Coding & Cryptography by Ranjan Bose, 2nd edition, Tata McGraw Hill Publishing Company Limited.
7. Digital Communications by Sanjay Sharma, S.K.Kataria & Sons.
8. Digital and Analog Communication Systems by K. Sam Shanmughan, John Wiley & Sons Pvt. Ltd.

**ETC 6.2 Peripheral Devices and Interfacing**

**Course Objectives (module-wise):**

**Module 1:** To teach about the peripheral devices at the input/output of processors, their instruction set and multipurpose (8155) Programmable peripheral devices.

**Module 2:** To teach Programmable devices such as 8255(Programmable I/O device) 8259(Programmable Interrupt controller) and 8251(Programmable communication Interface).

**Module 3:** To teach about following peripherals:

- 8279(Keyboard/ display controller)
- 8253(Programmable Interval Timer)
- 8237(Programmable DMA Interface).

**Module 4:** To teach about the following peripherals:

- 8272(Floppy disk controller)
- 8275(CRT Controller) and
- Interfacing ADCs and Buses.

**Instructional Objectives:**

- To give an exhaustive coverage of peripheral devices used for interfacing with microprocessors in various applications.
- To train the students to analyse and design microprocessor-based systems used in instrumentation and process control.

# ETC 6.2 PERIPHERAL DEVICES & INTERFACING

## MODULE I

1. **Input Output Organization**
   Peripheral devices, Input output interface: I/O bus and interface Modules, I/O bus versus Memory Bus, Isolated V/s Memory mapped I/O, Example of I/O interface
   Asynchronous data transfer: strobe control, hand shaking Asynchronous Serial transfer, Asynchronous Communication Interface, FIFO buffer.
   Modes of transfer: Programmed I/O, Interrupt initiated I/O
   Priority interrupt: Daisy chaining priority, Parallel Priority Interrupt, Priority Encoder, Interrupt Cycle, Software routines, Initial And final Operations
   Direct Memory Access(DMA): IDMA controller, DMA transfer,

Input output processor(IOP): CPU – IOP Communication, IBM 370 I/O Channel, Intel 8089 IOP
Serial Communication: Character Oriented Protocol, Data Transparency, Bit oriented Protocol (6)

2. **Interfacing I/O devices**
Peripheral I/O Instructions and Execution, Device selection and data transfer, Input interfacing, Interfacing I/Os using Decoders, Interfacing Output Displays, Interfacing Input devices, Memory Mapped I/O (2)

3. **8155 - Multipurpose Programmable Device**
Pin Configuration and Block diagram, Programmable I/O ports and Timer, Interfacing 8155 I/O ports, 8155 timer, 8155 ports in handshake mode. (2)

## MODULE II

1. **8255 - Programmable I/O Device / Programmable Parallel Port**
Internal Block diagram, Operational modes and Initialization, Control words, Interfacing 8255. (3)

2. **8259 - Programmable Interrupt Controller**
Block diagram, Pin diagram, Architecture and signal descriptions, Command words, modes of operation, Interfacing and programming of 8259 (3)

3. **8251 - Programmable Communication Interface - USART**
Block diagram, Pin diagram, Architecture and signal descriptions, operating modes, command instruction format, interfacing & programming 8251 with 8086.
(4)

## MODULE III

1. **8279 - Keyboard/Display Controller**
Internal Architecture, Pin configuration, Signal descriptions, Modes of operation,

Command words, Key code and Status Data Formats, Interfacing & programming

8279 with 8086. (3)

2. **8253 - Programmable Interval Timer**
Architecture & signal description, Operating modes of 8253, Control word, programming & interfacing 8253. (3)

3. **8237 - Programmable DMA interface**
   Internal Architecture, Register Organization, Signal descriptions, Register Organization, DMA operations with 8237, Transfer modes, 8237 Commands and Programming. Interfacing 8237 with 8086. (4)

## MODULE IV

1. **8272 - Floppy Disk Controller**
   Internal Architecture, Signal description, Functional details (2)

2. **8275 - CRT Controller**
   Internal Architecture, Signal description, System Operation, Display formats & operational features. (2)

3. **Analog to Digital Converters and interfacing**:
   ADC 0808/0809, Interfacing 0808 with 8086 through 8255. (2)

4. **Interfacing Digital to Analog Converters :**
   DAC 0800, interfacing DAC 0800 with 8086 (2)

5. **Interfacing buses**
   IEEE 488 (GPIB) & RS - 232C (2)

**Textbooks:**


1. Advanced Microprocessors & Peripherals by A.K.Ray & K.M.Bhurchandi
2. Computer System Architecture by Morris Mano
3. Microprocessors & interfacing by D.V.Hall
4. Microprocessors - Architecture, Programming & Applications by Ramesh Gaonkar


**Reference books:**


1. Introduction to Microprocessors by A.P. Mathur
2. Microprocessors - Principle & Applications by Ajit Pal.

# ETC 6.3 POWER ELECTRONICS

## Course Objectives (Module-wise) :

**Module 1** **:** To teach about the characterization of various semiconductor devices used in power electronics.

To study the switching of various devices and also their protection in power electronic application.

**Module 2** **:** To study the mechanical aspects such as mounting and heat sinking of power semiconductor devices.

To teach about the triggering of power semiconductor devices.

To teach the working principle and applications of AC to DC converters.

**Module 3** **:** To teach about choppers and their control schemes.

**Module 4** **:** To teach about Inverters and control of AC drives using power semiconductor devices.

## Instructional Objective:

To familiarize the students with the power semiconductor devices and their applications in industry.

### ETC 6.3 POWER ELECTRONICS

### MODULE –I

Introduction to Thyristor family :
Structure, Symbol, V.I. Characteristics of SCR

(2 Hours)

Transistor analogy
Thyristor Turn-on methods,
Switching characteristics of Thysistors during Turn On & Turn OFF
Thyristors commutations

(4 Hours)

Thyristor protection:– over voltage protection, suppression of over voltages, over current protection, di/dt protection, dv/dt protection, snubber circuits.

(4 Hours)

### MODULE II

Mounting of thyristors, series and parallel operation of thyristors,
Thyristor trigger circuits:- RC firing circuits (half wave & Full wave) Ramp triggering,

Ramp and pedestal trigging. (4 Hours)

Triac
Gate turn off Thyristors its structure, characteristics, applications (1 Hour)
PUT
Insulated gate bipolar transistor (1 Hour)

AC to DC converters :- Principle of phase control, single phone half-wave thysistor rectifier with RL load and RLE load. Single phase mid-point thysistor converter.
( 4 hours)

**MODULE III**

DC to DC converters (choppers) :– principle of operation, (2 hours)
Control Schemes :– Constant frequency scheme, variable frequency scheme, step up choppers. (6 hours)
Choppers classification:- Class A,B,C, D,& E (Numericals) (2 Hours)

**MODULE IV**

Inverters :- parallel inverter :- Basic Parallel inverter, modified parallel inverter.
(2 Hours)
Series inverter :- Basic series inverter, modified series inverter, (2 Hours)

Single phase half bridge inverter (mathematical analysis)
Single phase full bridge inverter (mathematical analysis)
MC murray –bedford half bridge inverter. (3 Hours)

Three phase inverter for 1800 and 1200 mode operations
DC motor speed control: – principle of speed control, phase controlled converters.
(2 Hours)
AC Drives: - Speed control by static voltage control, variable voltage variable frequency control.
( 1 hours)

**Text books:**

1. Introduction to Power Electronics By V. Jagannathan (prentice –Hall of India Pvt. Ltd, New Delhi)

2. Power Electronics circuits, Devices & applications By mohammed H Rashid (Prentice –Hall of India Pvt. Ltd., New Delhi)

**Reference Books**:

1. Thysistor Engineering by Berde
2. Power Electronics by P.C. Sen

# ETC 6.4 ANTENNA AND WAVE PROPAGATION

## Course Objectives (Module-wise) :

**Module 1** **:** To teach basic antenna concepts and parameters.

To teach about the analysis and synthesis of antenna field patterns.

**Module 2** **:** To teach about the Antenna arrays, and analysis of their field patterns.

**Module 3** **:**To teach about the special purpose antennas and their field patterns.

To teach about the antenna measurements.

**Module 4** **:** To teach about the radiowave propagation by means of ground-wave, Troposheric wave and sky-wave.

## Instructional Objective:

To expose the students to the fundamentals of electromagnetic radiation and propagation.

To teach about the composition, characteristics and application of antennas as an efficient electromagnetic interface and as a vital link in communication.

### ETC 6.4: ANTENNA AND WAVE PROPAGATION

### MODULE 1

Basic Antenna Concepts and Antenna Parameters, Antenna Aperture and Aperture Efficiency. (3 Hours)

Maximum Effective Aperture of a Short Dipole and a Linear Half-Wave Antenna Friss transmission formula. (2 Hours)

Point Sources, Power patterns, power theorem, radiation intensity, different power patterns (hemispherical, unidirectional and bi-directional cosine, sine, sine-squared cosine squared and (cosine). (4 Hours)

Field and phase patterns, effect of earth field patterns. (1 Hour)

### MODULE 2

The short electric dipole: Retarded vector potential, fields and radiation resistance, Radiation resistance of a half wave dipole and half wave antennas with a uniform traveling wave. (3 Hours)

Various forms of Antenna arrays; Arrays of point sources: Isotropic point sources of : (i) same amplitude and phase (ii) same amplitude but opposite phase (iii) same amplitude and in phase quadrature (iv) equal amplitude and any phase (v) unequal amplitude and any phase. (3 Hours)
Patterns multiplication: Radiation pattern of four and eight isotropic elements fed in phase, linear array with n isotropic point sources with equal amplitude and spacing; broadside case; End-fire case. (2 Hours)

End-fire array with increased directivity, phased array and scanning arrays. (2 Hours)

## MODULE 3

Loop antenna: field of a small loop, field pattern of circular and square loop, ferrite-rod antenna; Helical Antenna: Geometry, transmission and radiation modes, design of monofilar axial mode type, Wide-band characteristics, tapered monofilar axial mode type. (2 Hours)

Construction, characteristics of : Slot antennas, slotted cylindrical antennas, Aperture antenna, Horn antennas (rectangular and circular), Reflector antennas: Corner, paraboloidal, cylindrical parabolic, Cassegrain feed, Lens antennas, dielectric rod antennas. (3 Hours)

Yagi-Uda array, V- and Rhombic-antenna;, Turnstile antennas; Baluns and traps. ( 1 Hour)

Antenna Measurements: Directivity, gain, phase, terminal impedance, current distribution, polarization; system temperature and signal-to-noise ratio. (2 Hours)

Broad-band and frequency-independent antennas: Planar spiral, conical-spiral, Log-periodic antenna and array. (2 Hours)

## MODULE 4

Ground-wave propagation, Plane-earth reflection, space wave, elevated dipoles above plane earth, line of sight propagation, wave tilt of the surface wave, spherical earth propagation. (2 Hours)

Tropospheric propagation: waves, abnormal refraction and reflection, Duet propagation, Tropospheric scattering, Fading and Diversity reception. (3 Hours)

Ionospheric Propagation: Layers, permittivity and conductivity, collision and plasma frequency. (1 Hour)

Reflection and refraction, refractive index, electron density, determination of critical frequency and virtual height (1 Hour)

Maximum usable frequency, skip distance, optimum frequency, regular and irregular variations. (1 Hour)
Sky-wave transmission, effect of Earth's magnetic field, Whistlers; Incoherent scatter, VLF propagation. (2 Hours)

## TEXT BOOKS

I. Antenna & Wave Propagation by K. D. Prasad.
2. Electromagnetic Fields and Waves by Jordan & Balmain.

## REFERENCE BOOKS

3. Antennas by J.D. Kraus

# ETC 6.5. Electronics Instrumentation

***Course objectives: (Module-wise):***

***Module 1*:**

*To teach the principles of measurement of fundamental quantities such as time and frequency.*

*To teach the block schematic and principle working of signal generator and measuring instruments.*

***Module 2**:*

To teach about the 'Electronic Eye' ( Cathode Ray Oscilloscope) in all it aspects and also the principle of working and applications of a spectrum analyzer.

**Module 3:**

**To teach in detail about various transducers and their applications in measurements.**

**To teach about the basics of a Data Acquisition system.**

Module 4**:**

**To familiarize the students with Programmable logic controllers, associated devices and programming**

Instructional Objectives**:**

- **To teach the basic principles of measurements of non-electrical quantities such as displacement, velocity, pressure, temperature, flow, time period.**
- **To teach the basic principle of measurements of electrical quantities such as voltage , frequency, spectrum**
- **To teach the block schematic, merits and demerits and principle of operation of all the instruments used in measurements.**
- **To teach about the Programmable logic controller and related aspects of Process control instrumentation.**
- **To train the students in the design and analysis of instrumentation systems.**

# ETC 6.5 ELECTRONIC INSTRUMENTATION

MODULE1

**Frequency & Time Measurements: Time definition & standards, Standard Frequency & Time Signal Broadcasts, Time and Frequency Standards (2) Signal generators: Frequency synthesized signal generators, sweep frequency signal generators, (1) Electronic Voltmeters (Analog): Chopper stabilized DC(Low frequency) voltmeter, different methods of chopping, true RMS responding voltmeters. (1)**
**Electronic Voltmeter(digital):**
**Non-integrating type: Ramp type, Staircase Ramp, Continuous balance, Successive Approximation (2)**
**Integrating type: Voltage to frequency, Potentiometer Integrating, Dual Slope integrating Voltmeter (2)**
**Digital Multimeter: Block Diagram, General specification of a DVM, Sensitivity & Resolution of a DVM (1)**
**Electronic Voltmeter (High Frequency measurement): Sampling Voltmeter (1)**

MODULE 2

**Oscilloscope: Block diagram, Classification of CRO's, CRT control circuits, Electrostatic focusing, Delay lines, single trace, multiple trace CRO's, Time base circuits, Synchronizing circuits, Z-modulation.**
**(4) CRO probes: Active & Passive probes, Compensation for probes. Screen for CRTs Graticule**
**(1) Types of Oscilloscops :Digital storage oscilloscope, sampling oscilloscope**
**(1) Applications of CRO's: Phase & frequency measurements using triggered sweep method and by using Lissajous patterns (1)**
**Spectrum Analyzer: General Block Diagram, Swept Super heterodyne Spectrum Analyzer, FFT based Spectrum Analyzers, frequency Resolution & Bandwidth, Sweep Desensitization, sensitivity of spectrum Analyzer, Application of spectrum Analyzers (3)**

MODULE 3

**Displacement Transducer: Basic displacement measurement scheme, different types of displacement transducers: strain gauge, linear variable differential transformer, Capacitive, Inductive, Piezoelectric, Potentiometer.**
**(2) Velocity Transducers: Basic principle of measuring velocity, Tachogenerator, Stroboscopic method of measuring rpm (revolutions/minute)**
**(1) Pressure Transducers: Inductive, resistive and capacitive transducers for measuring pressure.**
**(1) Temperature Measurement Transducers: Resistance Temperature Detectors, Thermistors, Thermocouples.**
**(2) Flow measurement transducers: Turbomagnetic Flowmeter, Electromagnetic**

**Flowmeter, and Ultrasound Flowmeter.**
**(2) Data Acquisition Systems (DAS): Basic block diagram of Data Acquisition System, Objective of DAS, Signal Conditioning of the inputs, Instrumentation Amplifier, Isolation Amplifier.**
**(2)**

MODULE 4

**Programmable Logic Controllers (PLC): PLC Advantages & Disadvantages, Overall PLC System, CPU & Programmable Monitors, PLC input & Output Modules(Interfaces). (1) General PLC Programming Procedure : Proper Construction of PLC Ladder diagrams, Process Scanning considerations.**
**(1) Devices to which PLC input & output are connected: Input ON/OFF switching devices, Input analog devices, ON/OFF devices, Output analog devices. (1) Basic PLC Programming :**
**(7) (i) Programming ON-OFF inputs to produce ON-OFF outputs: PLC input instructions, Outputs Coils, Indicators, Operational Procedures, Constant Coil input & output programming examples, Fail Safe circuits, Industrial Process Example. (ii) Relation of digital gate Logic to Contact /Coil Logic: Digital logic gates & PLC equivalents, Boolean Algebra PLC programming, Conversion Examples.**
**(iii) Creating Ladder Diagrams from Process Control Descriptions: Ladder diagrams & Sequence listing, Large Process Ladder diagram construction.**
**(iv) PLC Timer Functions: PLC timer functions, Examples of timer and their industrial applications, Industrial process timing applications.**
**(v) PLC Counter functions : PLC Counters, Examples of Counter Functions, Industrial applications.**
**(vi) Selecting a PLC: PLC versus Personal Computer, Factors to consider while selecting a PLC**

TEXT BOOKS:


1. **Modern Electronic instrumentation & Measurement by Helfrick & Cooper, Prentice Hall of India.**
2. **Electronic Measurements & Instrumentation by Oliver, Cage, Tata McGraw Hill Publishing Company Limited**
3. **Principles of Industrial Instrumentation by D.Patranabis, Tata McGraw Hill Publishing Company Limited**
4. **Programmable Logic Controllers: Principles & Applications, 5th Edition, John Webb, Ronal Weiss, Prentice Hall of India.**


REFERENCE BOOKS :


1. **Electronic Instrumentation by Kalsi, Tata McGraw Hill.**
2. **Introduction to Programmable Logic Controllers by Gary Dunning, 3rd Edition, Thomson/Delmar Learning.**
3. **Principle of Measurement and Instrumentation by Alan S. Morris, Prentice Hall of India, 2nd Edition.**
4. **A First Course in Electronics & Electrical Measurement and Instrumentation by**

**J.B.Gupta, S.K.Kataria & Sons.**
**5. Principles of Electronic Instrumentation by D.Patranabis, Prentice Hall of India**

## ETC 6.6 VLSI TECHNOLOGIES AND DESIGN

## Course Objectives (Module-wise) :

**Module 1** **:** To introduce the structure, characteristics and principle of operation of MOS devices.

**Module 2** **:**To introduce students to SPICE modeling.

To teach in detail the switching characteristics of MOS devices.

To teach in detail, CMOS logic gate design.

**Module 3** **:** To introduce the silicon semiconductor technology and basic CMOS technology

To teach about the circuit layout design of MOS devices and components.

**Module 4** **:**To teach VLSI design methodologic using VHDL.

## Instructional Objective :

To introduce students to the field of microelectronics in general and VLSI in particular .

To teach about the characterization of MOS devices and components, their fabrication and circuit design (Application specific or custom) Automatic testing and design verification.

## ETC 6.6VLSI TECHNOLOGY AND DESIGN

**Module I**

**MOS transistor switches :** CMOS logic- Inverter, NOR, NAND and combinational logic , compound gates , Multiplexers ,Transmission gates, latches and Registers. **2 hrs**

**MOS Transistor :** Structures, MOS system under external bias, operation of MOS transistor (MOSFET), threshold voltage, MOSFET I-V characteristics , **3 hrs**

Channel Length Modulation, substrate bias effect, measurements of parameters – $K_N$, $V_{TP}$ & $\gamma$, MOSFET capacitances. **2 hrs**

**MOS Inverters :** Static load MOS Inverters , CMOS Inverter Design: Operation ,DC Characteristics, Noise margins , Power and Area considerations. **3 hrs**

**Module II**

Modeling of MOS transistor circuits using **SPICE** (level1 model equations) **3 hrs**

**Switching Circuit Characteristics :** Rise , fall and delay time , Gate delays , Transistor sizing , static and dynamic power dissipations. **3 hrs**

**CMOS logic gate design** : Fan –in and fan out , NOR , NAND and Complex logic gates and their layouts ( Euler paths). CMOS logic- Inverter, NOR, NAND and combinational logic , compound gates , Multiplexers ,Transmission gates, latches and Registers **4 hrs**

**Module III**

**Silicon semiconductor Technology:** Wafer processing, Oxidation, Epitaxy, Deposition, Ion-implantation and Diffusion silicon gate process. **4 hrs**

**Basic CMOS technology:** n-well and p-well CMOS process. Silicon on insulator. **2 hrs**

**MOSIS layout design** rules (full-custom mask layout designs), stick diagrams, layout editors (Magic/Micro Wind) and circuit extraction. **3 hrs**

**FPGA and CPLD:** features , differences and working **1 hr**

**Module IV**

**VLSI design methodologies:** VLSI design flow, design analysis, simulations: circuit, timing, switch-level, gate-level (or logic). Using HDLs : **VHDL** **5 hrs**

**Design verification**: Electrical, timing, functional . **Design synthesis:** Circuit and logic Synthesis. **1 hr**

**Testing :** Test procedure, Design for Testability (DFT) Scan – Based Test, Boundary- Scan Design, Built in self test (BIST). **2 hrs**

Automatic Test-Pattern generation (ATPG). Fault models and its simulation. **2 hrs**

**Textbooks:**


1. CMOS Digital Integrated Circuits (Analysis and Design) by Yusuf and Kong.
2. Principles of CMOS VLSI Design by Neil H.E. Weste, Kamran Eshranghian.
3. Digital Integrated Circuits – (Design perspective) by Jan M. Rabaey.
4. Fundamentals of Digital logic with VLSI design by Stephen Brown, Zvonco Vranesic


**Reference books:**


1. Basic VLSI Design by Douglas Pucknell, Kamran Eshraghian, PHI.
2. Modern VLSI design (Systems on Silicon) by Wayne Wolf.
3. Introduction to VLSI design by Eugene D. Gabricius.
4. VHDL by Douglas Perry.
5. VHDL Primer by J. Bhaskar.