SYLLABUS

FOR

INTEGRATED MASTER OF SCIENCE
IN
ELECTRONICS, COMPUTER AND
INSTRUMENTATION
[M.Sc. (ECI)]

A Five year Degree Course

SAURASHTRA UNIVERSITY
RAJKOT
(Effective from June 2010)

<u>Department of Electronics</u>
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SAURASHTRA UNIVERSITY
DEPARTMENT OF ELECTRONICS
M.Sc. (ECI) SYLLABUS
SEMESTER I TO IV

SEMESTER I	**(24 Credits)**	
Paper-1	ECI Mathematics – I	**(4 Credits)**
Paper-2	Basic Physical Electronics	**(4 Credits)**
Paper-3	Computer Concepts: Hardware and Software	**(4 Credits)**
Paper-4	Communication Skills and Technical Writing	**(4 Credits)**
	Practical's	**(8 Credits)**

SEMESTER II	**(24 Credits)**	
Paper-5	ECI Mathematics – II	**(4 Credits)**
Paper-6	Basic Circuit Analysis	**(4 Credits)**
Paper-7	Introduction of Digital Electronics	**(4 Credits)**
Paper-8	Electronic Devices and Circuits	**(4 Credits)**
	Practical's	**(8 Credits)**

SEMESTER III	**(24 Credits)**	
Paper-9	Circuits and Networks	**(4 Credits)**
Paper-10	Digital Electronics	**(4 Credits)**
Paper-11	Amplifier and Oscillator Circuits	**(4 Credits)**
Paper-12	Introduction to PSPICE	**(4 Credits)**
	Practical's	**(8 Credits)**

SEMESTER IV	**(24 Credits)**	
Paper-13	Power Electronics	**(4 Credits)**
Paper-14	Fundamental of Communication Electronics	**(4 Credits)**
Paper-15	Op-amp and its Applications	**(4 Credits)**
Paper-16	Basic Instrumentation	**(4 Credits)**
	Practical's	**(8 Credits)**

M.Sc. (ECI)
Detailed Syllabus

SEMESTER I

Paper 1: ECI Mathematics -I

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1: Numbers

Integers

Introduction-properties of addition and subtraction-multiplication of integers-properties of multiplication of integers-division of integers-properties of division of integers-factors and multiples-LCM and GCD-Exercise

Fraction and Decimals

Definition of fraction-multiplication of fraction-division of fraction-definition of decimal number-multiplication of decimal numbers-division of decimal numbers-Exercises

Rational numbers

Need for rational numbers-positive and negative rational numbers-rational number on number line-rational number in standard form-comparison of rational numbers-rational numbers between two rational numbers-Exercises

Squares and Square roots

Introduction-properties of square numbers-some more interesting pattern-finding the square of a number-square root-square root of decimals-estimating square root-Exercises

Exponents & Powers

Introduction-laws of exponent-use of exponents to express small numbers in standard form-Exercises

Real numbers

Introduction-Euclid's division lemma-fundamental theorem of arithmetic-revisiting irrational numbers-revisiting rational numbers and their decimal expansions-Exercises

Unit 2: Algebra of unknown numbers

Algebraic expression

How are expression formed-terms of expression-like and unlike terms-monomials, binomials, trinomials, and polynomials-addition and subtraction of algebraic expression-finding the value of an expression-using algebraic expression-formulas and rules-Exercise

Factorization

Introduction-what is factorization-division of algebraic expression-Exercise

Linear Equations in one variable

Introduction-solving equations which have linear expressions on one side and numbers on the other side-application-solving equations having variable on both sides-application-exercise

Pair of linear equation in two variables

Introduction-pair of linear equation in two variables-graphical method of solution of a pair of linear equation-algebraic methods of solving a pair of linear equation-elimination method-cross multiplication method-equations reducible to a pair of linear equation in two variables-Exercise

Quadratic Equation

Introduction-quadratic equation-solution of quadratic equation by factorization- solution of a quadratic equation by completing the square-nature of roots-Exercise

Polynomials

Introduction-polynomial in one variable-remainder theorem-factorization of polynomials-algebraic identities

Arithmetic Progressions

Introduction-arithmetic progression-nth term of an AP-sum of first n terms of an AP-Exercise

Direct and Inverse proportions

Introduction-direct proportion-inverse proportion-Exercise

Unit 3: Geometry

Lines and Angles

Introduction-related angles-pairs of lines-checking for parallel lines

The triangle and its properties

Introduction-medians of a triangle-altitudes of a triangle-exterior angle of a triangle and its properties-angle sum properties of a triangle-two special triangles: Equilateral and isosceles-sum of the lengths of two sides of two sides of a triangle-right angled triangles and Pythagoras property-Exercise

Congruence of triangles-criteria for congruence of triangles-some properties of a triangle-some rare criteria for congruence of triangles-inequalities in a triangle-Exercise

Quadrilaterals

Introduction-angle sum property of a quadrilateral-types of quadrilateral-properties of a parallelogram-another condition for a quadrilateral to be a parallelogram-the mid point theorem-Exercise

Area of parallelogram and triangles

Introduction-figures on the same base and between the same parallels-parallelogram on the same base and between the same parallels-triangles on the same base and between the same parallels-Herons formula-Exercise

Circle

Introduction-circles and its related terms: a review-angle subtended by a chord at a point-perpendicular from the center to a chord-equal chords and their distances from the center-angle subtended by an area of a circle-cyclic quadrilateral-perimeter and area of a circle-area of a sector and segment of a circle-area of combination of plane figures-Exercise

Construction

Introduction-basic construction-some construction of a triangles-division of a line segment-construction of tangents to a circle-Exercise

Unit 4: Other Useful Topics

Introduction to trigonometry

Introduction-trigonometry ratio-trigonometric ratios of some specific angles-trigonometric ratios of complementary angles-trigonometric identities-Exercise

Data Handling

Looking for information-organizing data-grouping data-circle graph or pie chart-arithmetic mean-range-mode-median-using a bar graph with a different purpose

Probability and Statistics

Introduction-Probability-an experimental approach-collection of data-presentation of class-graphical representation of data-measures of central tendency-Exercise

Recommended-Book:

ECI Mathematics-1 by Dr. H. N. Pandya & Dr. A. A. Bhaskar

Paper 2: Basic Physical Electronics

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
BASIC CONCEPTS OF ELECTRICITY
Static electricity, Conductors, insulators, and electron flow, Electric circuits, Voltage and current, Resistance, Voltage and current in a practical circuit, Conventional versus electron flow.

OHM's LAW
How voltage, current, and resistance relate, An analogy for Ohm's Law, Power in electric circuits, Calculating electric power, Resistors, Nonlinear conduction, Circuit wiring, Polarity of voltage drops.

Unit 2
ELECTRICAL SAFETY
The importance of electrical safety, Physiological effects of electricity, Shock current path, Ohm's Law (again!), Safe practices, Emergency response, Common sources of hazard, Safe circuit design, Safe meter usage, Electric shock data.

SCIENTIFIC NOTATION AND METRIC PREFIXES
Scientific notation, Arithmetic with scientific notation, Metric notation, Metric prefix conversions, Hand calculator use.

SERIES AND PARALLEL CIRCUITS
What are "series" and "parallel" circuits?, Simple series circuits, Simple parallel circuits, Conductance, Power calculations, Correct use of Ohm's Law, Component failure analysis, Building simple resistor circuits.

Unit 3
ELECTRONICS AND ATOMIC STRUCTURE
Electronics, Atomic structure, Structure of elements, The electron, Energy of an electron, Valence electrons, Free electrons.
Bohr's atomic model, Energy levels, Energy bands, Important energy bands in solids, Classification of solids and energy bands.

Unit 4
SEMICONDUCTOR PHYSICS
Semiconductor, Bonds in semiconductors, Crystals, Commonly used semiconductors, Energy band description of semiconductor, Effect of temperature on semiconductors, Hole current, Intrinsic semiconductor, Extrinsic semiconductor, n-type semiconductor, p-type semiconductor, Charge on n-type and p-type semiconductors, Majority and minority carriers, pn-junction, Properties of pn-junction, Applying voltage across pn-junction, Current flow in a forward biased pn-junction, Volt-ampere characteristics of pn-junction, Important terms, Limitations in operating condition of pn-junction.

Recommended-Book:
1. Basic Physical Electronics-I by Dr. A. A. Bhaskar & Dr. H. N. Pandya

Paper 3: Computer Concepts: Hardware and Software

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1: Fundamentals of Computer Hardware

1.1 Basic Computer Organization
Input unit, Output Unit, Storage Unit, Arithmetic Logic Unit, Control Units, the system concepts.

1.2 Processor and Memory
The Central Processing Unit:
The control unit, The ALU, Instruction Set, Registers, Processor Speed, Types of processors.
The Main Memory:
Storage evaluation criteria, Main memory organization, Main memory capacity, RAM, ROM, PROM, and EPROM, Cache memory.

1.3 Secondary Storage Devices
Magnetic Disk:
Basic principles of operation, Types of magnetic disks, Advantage and Limitations of magnetic disks, Uses of magnetic disks.
Optical Disk:
Basic principles of operation, Types of optical disks, Advantages and Limitations of optical disks, Uses of optical disks.

1.4 Input-Output Devices
Input Devices:
Keyboard, Point and Draw, Data Scanning, Digitizers, Electronic card reader, Voice recognition devices, Vision input system.
Output Devices:
Monitors, Printers, Plotters, Screen image projector, Voice response system.

Unit 2: Fundamentals of Computer Software's

Computer Software
What is Software, Relationship between hardware and software, Types of software, Logical system architecture, Acquiring software, Software development steps, Firmware.
Computer languages
Machine language, Assembly language, Higher level language, Object oriented programming languages, Some high level languages, more high level languages, Characteristic of a good programming language, Selecting language for coding an application.

Operating Systems

What is an operating system, Measuring systems performance, Process management, Memory management, file management, Security, Command interpretation, OS capability enhancement software, some popular operating systems.

Application Software Packages

Word processing package, Spreadsheet package, Graphic package, Personal assistance package.

Unit 3: Computer Communication

3.1 Data Communication and Computer Network

Basic elements of communication system, Data transmission: modes, speed, and media (twisted pair, coaxial cable, microware, Satellite, Optical fiber). Digital and Analog data transmission (modulation, techniques, modem), Data transmission services, Communication processes, multiplexers, concentrators, Front end processors, Asynchronous and Synchronous transmission, Switching technique, routing technique, Network topology, Network types, Communication protocols, Internet working tools, Wireless networks, Distributed computing system.

3.2 The Internet

Definition, brief history, its basic services, www browsers, uses of internet.

3.3 Multimedia

What is multimedia, what is multimedia computer system, multimedia components, multimedia application.

3.4 Classification of Computers

Notebook, PC, Workstation, Mainframe, Supercomputers, Clients and servers.

1. *Recommended-Book*: "Computer Fundamentals" by P. K. Sinha and Priti Sinha. BPB publication.
2. *Reference-Book*: "PC Complete" BPB publications.
3. *Reference-Book*: "A+ Guide to PC Hardware by Micheal Meyers, TMH Publication

Paper 4: Communication Skills and Technical Writing

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
COMMUNICATION: ITS TYPES AND SIGNIFICANCE: Basic Concepts of Communication; Process of Communication; Types of Formal communication; The Media of Communication; Channels of Communication; Barriers in Communication; How to Overcome Barriers to Communication.

Unit 2
Grammar: Synonyms; Antonyms; Words used as different parts of speech; Spotting errors; Concord; Principle of proximity between subject and verb.

Unit 3
Syntax: Sentence Structure; Combination and Transformation of sentences; Verb Patterns in English.

Unit 4
Reading Skills: Purpose and Process of Reading; Reading Tactics; Reading Strategies; Reading Comprehension; Paraphrase; Preparing outlines of paragraph/text.

Unit 5
Writing Skills: Elements of Effective Writing; Job Application, Bio-data, Personal Resume and Curriculum Vitae; Preparing Agenda and Minutes of a Meeting; Back office job for organizing a conference/seminar; Writing Styles; Scientific and Technical Writing; Summary Writing; Writing paragraphs; Writing Essays.

Unit 6
Listening Skills: Process of listening; Hard and Soft Skills; Feedback Skills; Essentials of Good Communications; Types of Listening; Barriers to Listening; Note taking and Note making.
Speaking Skills: Skills of Effective Speaking; Component of an Effective Talk; Tone of Voice; Accent, Body Language; Timing and Duration of Speech; Audio-Visual Aids in Speech.

Unit 7
Technical Report: Main considerations in writing a good report; Types and Structure of Reports; Collecting Data; Technical Proposals; Visual Aids; General Tips for Writing Reports.

Unit 8
Self Development: Know yourself; Tips for giving an Interview; Body language for Interviews; Group Discussion; Skills of participating in meeting; Attending Calls; Soft Skills & Leadership.

Recommended-Book
I The Functional Aspects of Communication Skills, Prajapati Prasad and Rajendra K. Sharma, S. K. Kataria & Sons, New Delhi, Reprint 2007**.**

Reference Books
1 Business Communication, Sinha K. K, S. Chand, New Delhi.
2 Business Communication, Asha Kaul, Prentice Hall of India.
3 Business Correspondence and Report Writing: A Practical Approach to Business and Technical Communication, Sharma, R.C. and Krishna Mohan, Tata McGraw-Hill.
4. A New Approach to English Grammar for High Schools, Madan Sabina, Spectrum Books, New Delhi.

Set of 10 Experiments + One Project   **(Credit 08)**

SEMESTER II

Paper 5: ECI Mathematics-II

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1: Functions, Limits and Derivatives
Sets: Sets and their representations, the empty sets, finite and infinite sets, equal sets, subsets, power set, universal set, Venn Diagram, Operation on sets, Complements of a Set, Practical Problems on Union and Intersection of Two Sets
Relations and Functions: Cartesian Product of Sets, Relations and Types of Relations, Functions and Types of Functions, Composition of Functions and Invertible Function, Binary Operation
Trigonometric Function: Angles, Trigonometric Function, Trigonometric Function of Sum and Difference of Two Angles, Trigonometric Equations
Limits and Derivatives: Intuitive idea of derivatives, Limits, Limits of Trigonometric Function, Derivatives
Inverse Trigonometric Function: Basic Concepts, Properties of Inverse Trigonometric Functions

Unit 2: Differentiation and Its Applications
Continuity and Differentiability: Continuity, Differentiability, Exponential and Logarithmic Functions, Logarithmic Differentiation, Derivation of Functions in Parametric Forms, Second Order Derivative, Mean Value Theorem
Application of Derivatives: Rate of Change of Quantities, Increasing and Decreasing Functions, Tangents and Normal, Approximation, Maxima and Minima

Unit 3: Integration and Its Applications
Integral: Integration as an Inverse Process of Differentiation, Methods of Integration, Integral of Some Particular Functions, Integration by Partial Fractions, Integration by Parts, Definite Integral, Fundamental Theorem of Calculus, Evaluation of Definite Integrals by Substitution, Some Properties of Definite Integrals
Application of Integrals: Area Under Simple Curves, Area Between Two Curves

Unit 4: Differential Equation and Vector Algebra
Differential Equations: Basic Concepts, General and Particular Solutions of a Differential Equation, Formation of a Differential equation Whose General Solution is Given, Methods of Solving First order First degree Differential Equations
Vector Algebra: Some Basic Concepts, Types of Vectors, Addition of Vectors, Multiplication of Vector by a Scalar, Product of Two Vectors

Recommended-Book
ECI Mathematics-2 by Dr. H. N. Pandya & Dr. A. A. Bhaskar

Paper 6: Basic Circuit Analysis

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Circuit Elements and Kirchhoff's Laws: Voltage, Current, Power and Energy, The Circuit, Resistance Parameter, Inductance Parameter, Capacitance Parameter, Energy Sources, Kirchhoff's Voltage Law, Voltage Division, Power in Series Circuit, Kirchhoff's Current Law, Parallel Resistance, Current Division, Power in Parallel Circuit

Unit 2
Methods of Analyzing Circuits: Introduction, Tree and Co-Tree, Twigs and Links, Incidence Matrix (A), Properties of Incidence Matrix A, Incidence Matrix and KCL, Link Currents: Tie-Set Matrix, Cut-Set and Tree Branch Voltages, Mesh Analysis, Mesh Equations By Inspection Method, Supermesh Analysis, Nodal Analysis, Nodal Equations By Inspection Method, Supernode Analysis, Source Transformation Technique

Unit 3
Useful Theorems in Circuit Analysis: Star-Delta Transformation, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Compensation Theorem, Maximum Power Transfer Theorem, Duals and Duality, Tellegen's Theorem, Millman's Theorem

Unit 4
Introduction to Alternating Currents and Voltages: The Sine Wave, Angular Relation of a Sine Wave, The Sine Wave Equation, Voltage and Current Values of a Sine Wave, Phase Relation in Pure Resistors, Phase Relation in a Pure Inductor, Phase Relation in Pure Capacitor

Unit 5
Complex Impedance: Impedance Diagram, Phasor Diagram, Series Circuit, Parallel Circuits, Compound Circuits

Unit 6
Power and Power Factor: Instantaneous Power, Average Power, Apparent Power and Power Factor, Reactive Power, The Power Triangle

Unit 7
Steady State Analysis: Mesh Analysis, Mesh Equations by Inspection, Nodal Analysis, Nodal Equations by Inspection, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

Unit 8

An Introduction to PSPICE: Introduction, What is PSPICE, Getting Started with PSPICE, Simulation Steps, Component Values, D.C. Analysis and Control Statements, Dependent Sources, D.C. Sweep, A.C. Analysis and Control Statements, Transient Analysis

Recommended-Book
1. Circuits and Networks: Analysis and Synthesis (second edition) by A Sudhakar and Shyammohan S Palli, Tata McGraw-Hill publication.

Reference Books
1. Basic Circuit Analysis By: D. R. Cunningham and J. A. Stuller. Publisher : A Jaico Book.
2. Circuit Theory by Iyer, Person Education.
3. Basic Circuit Theory by Hnelsman, PHI Publication

Paper 7: Introduction of Digital Electronics

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Number Systems and Codes: Analogue Versus Digital, Introduction to Number Systems, Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System, Number Systems, Number Representation in Binary, Finding the Decimal Equivalent, Decimal to Binary Conversion, Decimal to Octal Conversion, Decimal to Hexadecimal Conversion, Hex-Binary and Binary-Hex Conversion, Hex-Octal and Octal-Hex Conversion, The Four Axioms, Floating Point Numbers, Binary Coded Decimal, Excess-3 Code, Gray Code, Alphanumeric Codes, Seven Segment Display Code, Error Detection and Correction Codes

Unit 2
Digital Arithmetic, Logic Gates and Related Devices: Basic Rules of Binary Addition and Subtraction, Addition of Larger Bit Binary Numbers, Subtraction of Larger Bit Binary Numbers, BCD Addition and Subtraction in Excess-3 Code, Binary Multiplication, Binary Division, Floating Point Arithmetic.
Positive and Negative Logic, Truth Table, Logic Gates, Universal Gates, Gates with Open Collector/Drain Outputs, Tristate Logic Gates, AND-OR-INVERT Gates, Schmitt Gates, Special Output Gates, Fan-Out of Logic Gates, Buffers and Transceivers, IEEE/ANSI Standard Symbols, Application-Relevant Information

Unit 3
Logic Families: Logic Families, Characteristic Parameters, Transistor Transistor Logic, Emitter Coupled Logic, CMOS Logic Family, BiCMOS Logic, NMOS and PMOS Logic, Integrated Injection Logic, Comparison of Different Logic Families, Guideline to Using TTL Devices, Guideline to Handling and Using CMOS Devices, Interfacing with Different Logic Families, Classification of Digital ICs, Application-Relevant Information

Unit 4
Boolean Algebra and Simplification Technique: Introduction to Boolean Algebra, Postulates of Boolean Algebra, Theorems of Boolean Algebra, Simplification Techniques, Quine-McCluskey Tabular Method, Karnaugh Map Method

Recommended-Book
1. Digital Electronics: Principles and Integrated Circuits by Anil K Maini, Wiley Precise Text Book.

Reference Books
1. Design" by Morris Mano, PHI Publication
2. "Modern Digital Electronics" by R. P. Jain, TMH Publication.

Paper 8: Electronic Devices and Circuits

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1

Passive Circuit Components and Electron Ballistics: Introduction of Passive Circuit Components, Resistors, Capacitors, Inductors, Introduction of Electron Ballistics, Charged Particles, Force, Field Intensity, Potential, and Energy, Two-Dimensional Motion of Electron, Force in Magnetic Field, Motion in Magnetic Field, Parallel Electric and Magnetic Fields, Perpendicular Electric and Magnetic Fields, Electrostatic Deflection in Cathode Ray Tube, Magnetic Deflection in Cathode Ray Tube, Comparison Between Electric and Magnetic Deflection Systems

Unit 2

Semiconductor Diodes and Special Diodes: Introduction of Semiconductor Diode, Classification of Semiconductors, Conductivity of Semiconductors, Carrier Concentration in Intrinsic Semiconductors, Mass-Action Law, Properties of Intrinsic Semiconductors, Variation in Semiconductor Parameters with Temperature, Drift and Diffusion Currents, Carrier Life Time, Continuity Equation, Theory of PN Junction Diode, Energy-Band Structure of Open Circuited PN Junction, Quantitative Theory of PN Diode Currents, Diode Current Equation, Diode Resistance, Transition or Space Charge, Diffusion Capacitance, Effect of Temperature on PN Junction Diodes, Diode as a Circuit Element, Piecewise Linear Diode Model, PN Diode Applications
Introduction to Special Diodes, Zener Diode, Backward Diode, Varactor Diode, Step Recovery Diode, Point Contact Diode, Metal-Semiconductor Junctions, Tunnel Diode, Gunn Diode, Impatt Diode, Pin Diode, Pin Photodiode, Avalanche Photo Diode, Laser Diode

Unit 3

Bipolar Junction Transistor: Introduction, Construction, Transistor Biasing, Operation of NPN Transistor, Operation of PNP Transistor, Types of Configuration, Transistor as an Amplifier, Large Signal, DC, and Small Signal CE values of Current Gain, Breakdown in Transistors, Ebers-Moll Model, Bias Stability, Methods of Transistor Biasing, Bias Compensation

Unit 4

Field Effect Transistor: Introduction, Construction of N-channel JFET, Operation of N-Channel JFET, Characteristic Parameters of the JFET, Expression for Saturation Drain Current, Slope of the Transfer Characteristic at I_{DSS}, Comparison of JFET and BJT, Application of JFET, Metal Oxide Semiconductor Field Effect Transistor, Enhancement MOSFET, Depletion MOSFET, Comparison of MOSFET with JFET, Handling Precautions for MOSFET, Comparison of N- with P-Channel MOSFETs, Comparison of N- with P-Channel FETs, Biasing of FET, se of JFET as Voltage-Variable Resistor, Biasing the MOSFET, Charge Transfer Devices

Recommended-Book
1. Electronic Devices and Circuits by S Salivahanan, N Suresh Kumar, A Vallavaraj, Second Edition, The McGraw Hill Companies.

Reference Books
1. Electronic Devices & Circuits by J. B. Gupta. Publisher: S. K. Kataria & Sons, New Delhi.
2. Electronic Devices by Floyd, Pearson Education.
3. Complete Guide to Semiconductor Devices" by Kwok. N. G. , TMH Publication.
4. Basic Electronic Devices, NIIT, PHI.
5. Electronic Devices and Application: NIIT, PHI.

Set of 10 Experiments + One Project   **(Credit 08)**

SEMESTER III

Paper 9: Circuits and Networks

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Introduction to the Laplace Transform: Definition of the Laplace Transform, Step Function, Impulse Function, Functional Transforms, Operational Transforms, Laplace Transform of Periodic Functions, Inverse Transforms, Initial and Final Value Theorems.

Unit 2
Application of the Laplace Transform in Circuit Analysis: Circuit Elements in the S-Domain, Applications, Transfer Function, Use of Transfer Function in Circuit Analysis, The Transfer Function and the Convolution Integral, The Transfer Function and the Steady State Sinusoidal Response, The Impulse Function in Circuit Analysis.

Unit 3
S-Domain Analysis: The Concept of Complex Frequency, Physical Interpretation of Complex Frequency, Transform Impedance and Transform Circuits, Series and Parallel Combination of Elements, Terminal Pairs or Ports, Network Functions for the One-Port and Two-port, Poles and Zeroes of Network Functions, Significance of Poles and Zeros, Properties of Driving Point Functions, Properties of Transfer Function, Necessary Conditions for driving Point Function, Necessary Condition for Driving Transfer Function, Time Domain Response from Pole Zero Plot, Amplitude and Phase Response from Pole Zero Plot, Stability Criterion for Active Network, Routh Criteria.

Unit 4
Two Port Networks: Two-port Network, Open Circuit Impedance (Z) Parameters, Short Circuit Admittance (Y) Parameters, Transmission (ABCD) Parameters, Inverse Transmission (A'B'C'D') Parameters, Hybrid (h) parameters, Inverse Hybrid (g) Parameters, Inter Relationships of Different Parameters, Inter Connection of Two-port Networks, T and π Representation, Terminated Two-Port Network, Lattice Networks, Image Parameters.

Unit 5
Filters and Attenuators: Classification of Filters, Filter Networks, Equations of Filter Networks, Classification of Pass band and Stop band, Characteristic Impedance in The Pass and Stop Bands, Constant-K Low Pass Filter, Constant K-High Pass Filter, m-Derived T-Section, Band Pass Filter, Band Elimination Filter, Attenuators, T-Type Attenuator, π-Type Attenuator, Equalizers, Inverse network, Series Equalizer, Full Series Equalizer, Shunt Equalizer, Full Shunt Equalizer, Constant Resistance Equalizer, Bridge-T Attenuation Equalizer, Bridged-T Phase Equalizer, Lattice Attenuation Equalizer, Lattice Phase Equalizer.

Unit 6
Elements of Realizability and Synthesis of One-port Networks: Hurwitz Polynomials, Positive Real Functions, Frequency Response of Reactive One-Ports, Synthesis of Reactive One-Ports by Foster's Method, Synthesis of Reactive One-Ports by the Cauer Method, Synthesis of R-L Network by the Foster Method, Synthesis of R-L Network by Cauer Method, Synthesis of R-C Network by the Foster Method, Synthesis of R-C Network by Cauer Method.

Recommended-Book
1. Circuits and Networks: Analysis and Synthesis (second edition) by A Sudhakar and Shyammohan S Palli, Tata McGraw-Hill publication.

Reference Books
1. Basic Circuit Analysis By: D. R. Cunningham and J. A. Stuller. Publisher : A Jaico Book.
2. Circuit Theory by Iyer, Person Education.
3. Basic Circuit Theory by Hnelsman, PHI Publication

Paper 10: Digital Electronics

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Arithmetic Circuits: Combinational Circuits, Implementing Combinational Logic, Arithmetic Circuits – Basic Building Blocks, Half-Adder, Full Adder, Half-Subtractor, Full Subtractor, Controlled Inverter, Adder–Subtractor, BCD Adder, Carry Propagation–Look-Ahead Carry Generator, Arithmetic Logic Unit (ALU), Multipliers, Magnitude Comparator, Cascading Magnitude Comparators, Application-Relevant Information.

Unit 2
Multiplexers and Demultiplexers: Multiplexer, Inside the Multiplexer, Implementing Boolean Functions with Multiplexers, Multiplexers for Parallel-to-Serial Data Conversion, Cascading Multiplexer Circuits, Encoders, Priority Encoder, Demultiplexers and Decoders, Implementing Boolean Functions with Decoders, Cascading Decoder Circuits, Application-Relevant Information.

Unit 3
Programmable Logic Devices: Fixed Logic Versus Programmable Logic, Advantages and Disadvantages, Programmable Logic Devices – An Overview, Programmable ROMs, Programmable Logic Array, Programmable Array Logic, Generic Array Logic, Complex Programmable Logic Device, Field-Programmable Gate Array, Programmable ROMs, Programmable Logic Array, Programmable Array Logic, PAL Architecture, PAL Numbering System, Generic Array Logic, Complex Programmable Logic Devices, Internal Architecture, Applications, Field-Programmable Gate Arrays, Internal Architecture, Applications, Programmable Interconnect Technologies, Fuse, Floating-Gate Transistor Switch, Static RAM-Controlled Programmable Switches, Antifuse, Design and Development of Programmable Logic Hardware, Programming Languages, ABEL-Hardware Description Language, VHDL-VHSIC Hardware Description Language, Verilog, Java HDL, Application Information on PLDs, SPLDs, CPLDs, FPGAs.

Unit 4
Flip-Flops and Related Devices: Multivibrator, Bistable Multivibrator, Schmitt Trigger, Monostable Multivibrator, Astable Multivibrator, Integrated Circuit (IC) Multivibrators, Digital IC-Based Monostable Multivibrator, IC Timer-Based Multivibrators, R-S Flip-Flop, R-S Flip-Flop with Active LOW Inputs, R-S Flip-Flop with Active HIGH Inputs, Clocked R-S Flip-Flop, Level-Triggered and Edge-Triggered Flip-Flops, J-K Flip-Flop, J-K Flip-Flop with PRESET and CLEAR Inputs, Master–Slave Flip-Flops, Toggle Flip-Flop (T Flip-Flop), J-K Flip-Flop as a Toggle Flip-Flop, D Flip-Flop, J-K Flip-Flop as D Flip-Flop, D Latch, Synchronous and Asynchronous Inputs, Flip-Flop Timing Parameters, Set-Up and Hold Times, Propagation Delay, Clock Pulse HIGH and LOW Times, Asynchronous Input Active Pulse Width, Clock Transition Times, Maximum Clock Frequency, Flip-Flop Applications, Switch Debouncing, Flip-Flop Synchronization, Detecting the Sequence of Edges, Application-Relevant Data.

Unit 5

Counters and Registers: Ripple (Asynchronous) Counter, Propagation Delay in Ripple Counters, Synchronous Counter, Modulus of a Counter, Binary Ripple Counter – Operational Basics, Binary Ripple Counters with a Modulus of Less than 2N, Ripple Counters in IC Form, Synchronous (or Parallel) Counters, UP/DOWN Counters, Decade and BCD Counters, Presettable Counters, Variable Modulus with Presettable Counters, Decoding a Counter, Cascading Counters, Cascading Binary Counters, Cascading BCD Counters, Designing Counters with Arbitrary Sequences, Excitation Table of a Flip-Flop, State Transition Diagram, Design Procedure, Shift Register, Serial-In Serial-Out Shift Register, Serial-In Parallel-Out Shift Register, Parallel-In Serial-Out Shift Register, Parallel-In Parallel-Out Shift Register, Bidirectional Shift Register, Universal Shift Register, Shift Register Counters, Ring Counter, Shift Counter, IEEE/ANSI Symbology for Registers and Counters, Counters, Registers, Application-Relevant Information.

Unit 6

Data Conversion Circuits – D/A and A/D Converters: Digital-to-Analogue Converters, Simple Resistive Divider Network for D/A Conversion, Binary Ladder Network for D/A Conversion, D/A Converter Specifications, Resolution, Accuracy, Conversion Speed or Settling Time, Dynamic Range, Nonlinearity and Differential Nonlinearity, Monotonocity, Types of D/A Converter, Multiplying D/A Converters, Bipolar-Output D/A Converters, Companding D/A Converters, Modes of Operation, Current Steering Mode of Operation, Voltage Switching Mode of Operation, BCD-Input D/A Converter, Integrated Circuit D/A Converters, DAC-08, DAC-0808, DAC-80, AD 7524, DAC-1408/DAC-1508, D/A Converter Applications, D/A Converter as a Multiplier, D/A converter as a Divider, Programmable Integrator, Low-Frequency Function Generator, Digitally Controlled Filters, A/D Converters, A/D Converter Specifications, Resolution, Accuracy, Gain and Offset Errors, Gain and Offset Drifts, Sampling Frequency and Aliasing Phenomenon, Quantization Error, Nonlinearity, Differential Nonlinearity, Conversion Time, Aperture and Acquisition Times, Code Width, A/D Converter Terminology, Unipolar Mode Operation, Bipolar Mode Operation, Coding, Low Byte and High Byte, Right-Justified Data, Left-Justified Data, Command Register, Status Register, Control Lines, Types of A/D Converter, Simultaneous or Flash A/D Converters, Half-Flash A/D Converter, Counter-Type A/D Converter, Tracking-Type A/D Converter, Successive Approximation Type A/D Converter, Single-, Dual- and Multislope A/D Converters, Sigma-Delta A/D Converter, Integrated Circuit A/D Converters, ADC-0800, ADC-0808, ADC-80/AD ADC-80, ADC-84/ADC-85/AD ADC-84/AD ADC-85/AD-5240, AD 7820, ICL 7106/ICL 7107, A/D Converter Applications, Data Acquisition.

Recommended-Book
1. Digital Electronics: Principles and Integrated Circuits by Anil K Maini, Wiley Precise Text Book.

Reference Books
1. Design" by Morris Mano, PHI Publication
2. "Modern Digital Electronics" by R. P. Jain, TMH Publication.

Paper 11: Amplifier and Oscillator Circuits

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1

Midband Analysis of Small Amplifiers: Introduction, Two-Port Devices and Network parameters, The Hybrid Model for Two-Port Network, Analysis of a Transistor Amplifier Circuit Using h-Parameters, Simplified CE Hybrid Model, Analysis of CC Amplifier Using the Approximation model, Analysis of CB Amplifier using the Approximate model, The "re" Model of Transistor, BJT Amplifier, single Stage Amplifier, Small Signal analysis of Single Stage BJT Amplifier, FET Amplifiers, The FET Small-signal Model, Differential Amplifiers.

Unit 2

Multistage Amplifier: Introduction, Different Coupling Schemes used in Amplifiers, General Analysis of Cascade Amplifier, Choice of Transistor Configuration in Cascade Amplifier, RC Coupled Amplifier, Transformer Coupled Amplifier, Direct Coupled Amplifiers.

Unit 3

Frequency Response of Amplifiers: Introduction, General Shape of Frequency Response of Amplifiers, Bode plot Analysis, Transient Response, low Frequency Response of Transistor Amplifier, Effect of Coupling Capacitor $C_{C on}$ Low Frequency Response, High Frequency π model for a Transistor, FET Model at High Frequency, Frequency Response of FET Amplifier, Frequency Response of Multistage Amplifiers, RF Amplifiers, Video Amplifiers.

Unit 4

Large Signal Amplifiers: Introduction, Classification Based on Biasing Condition, Class A large Signal Amplifiers, Second harmonic Distortion, Higher Order harmonic Generation, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A Amplifiers, Push-Pull Amplifier, Distortion in Amplifier, Complementary Symmetry Push Pull Amplifier, Class D Amplifier, Class S Amplifier, MOSFET Power Amplifier, Thermal Stability and Heat Sink.

Unit 5

Tuned Amplifiers: Introduction, O-Factor, Small Signal Tuned Amplifiers, Effect of Cascading Single Tuned Amplifiers on bandwidth, Effect of Cascading Double tuned Amplifiers on Bandwidth, Stagger Tuned Amplifiers, Stability of Tuned Amplifiers, Neutralization.

FeedBack Amplifiers: Introduction, basic Concept of Feedback, Effects of Negative Feedback, Types of Negative Feedback Connections, Method of Identifying Feedback Topology and Feedback Factor, Stability of Feedback Amplifier.

Unit 6
Oscillators: Introduction, Classification of Oscillators, Conditions for Oscillation, General Form of an LC Oscillator, Hartley Oscillator, Colpitts Oscillator, Clapp Oscillator, Franklin Oscillator, Armstrong Oscillator, Tuned Collector Oscillator, RC Oscillator, Wien Bridge Oscillator, Twin T Oscillator, Crystal Oscillator, Miller Oscillator, Pierce Crystal Oscillator, Frequency range of RC and LC Oscillator, Frequency Stability of Oscillator, Negative Resistance Oscillators, Oscillators Using FET.

Unit 7
Wave Shaping and Multivibrator Circuits: Introduction, Waveform Shaping Circuits, Diode Clippers, Diode Comparator, Clampers, Multivibrators, Triggering Methods for Bistable Multivibrators, Schmitt Trigger.

Recommended-Book
1. Electronic Devices and Circuits by S Salivahanan, N Suresh Kumar, A Vallavaraj, Second Edition, The McGraw Hill Companies.

Reference Books
1. Electronic Devices & Circuits by J. B. Gupta. Publisher: S. K. Kataria & Sons, New Delhi.
2. Electronic Devices by Floyd, Pearson Education.
3. Complete Guide to Semiconductor Devices" by Kwok. N. G. , TMH Publication.
4. Basic Electronic Devices, NIIT, PHI.
5. Electronic Devices and Application: NIIT, PHI.

Paper 12: Introduction to PSPICE

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Introduction to PSPICE: Introduction, Description of Spice, Types of Spice, Types of Analysis, Description of Simulation Software Tools, PSpice Platform, PSpice Schematic Versus OrCAD Capture, Limitations of PSpice, SPICE Resources.
Circuit Descriptions: Introduction, Input Files, Element Values, Nodes, Circuit Elements, Sources, Types of Analysis, Output Variables, PSpice Output Commands, Format of Circuit Files, Format of Output Files, Examples of SPICE Simulations, OrCAD Capture, Importing Microsim Schematic in OrCAD Capture.

Unit 2
DC Circuit Analysis: Introduction, Resistors, Modeling of Elements, Operating Temperature, Independent DC Sources, Dependent Sources, DC Output Variables, Types of Output, Types of DC Analysis.

Unit 3
Transient Analysis: Introduction, Capacitor and Inductors, Modeling of Transient Sources, Transient Sources, Transient Output Variables, Transient Output Commands, Transient Response, Switches.

Unit 4
AC Circuit Analysis: Introduction, AC Output Variables, Independent AC Sources, AC Analysis, Magnetic Elements, Transmission Lines, Multiple Analyses.
Advanced SPICE Commands and Analysis: Introduction, Behavioral Modeling, Subcircuit, End of Subcircuit, Function, Global, Include File, Library File, Nodeset, Options, Parameter, Fourier Analysis, Noise Analysis, Sensitivity Analysis, Parametric Analysis, DC Parametric Sweep, Monte Carlo Analysis, DEV/LOT Device and Lot Tolerances, Sensitivity/Worst-Case Analysis.

Unit 5
Semiconductor Diodes: Introduction, Diode Characteristics, Analysis of Diode Circuits, Diode Model, Diode Statement, Diode Parameters, Examples of DC Analysis, Examples of Transient and AC Analysis.
Bipolar Junction Transistors: Introduction, BJT Model, BJT Statements, BJT Parameters, Examples of BJT Circuits.
Field-Effect Transistors: Introduction, Junction FET, JFET Parameters, Examples of JFET Amplifiers, Metal Oxide Silicon FET, MOSFET Parameters, Examples of MOSFET Amplifiers, Gallium Arsenide MESFETs.

Recommended-Book
1. Introduction to PSPICE Using OrCAD for Circuits and Electronics by Muhammad H. Rashid, Third Edition, Pearson Education.

Reference Books
1) Spice for circuits and electronics using PSPICE by M.H. Rashid PHI second edition.

Set of 10 Experiments + One Project   **(Credit 08)**

SEMESTER IV

Paper 13: Power Electronics

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Power Electronics Systems-An Overview: Introduction, History of Power Electronics Development, Power Electronics Systems, Power Semiconductor Devices, Power Electronic Converters, Power Electronic Applications, Computer Simulation Of Power Electronic Circuits.

Unit 2
Thyristor- Principles And Characteristics: Introduction, Principal Of Operation Of SCR, Static Anode- Cathode Characteristics Of SCR, The Two transistor model of SCR (Two transistor analogy), Thyristor Construction, Gate characteristics of SCR, Turn on method of a thyristor, Dynamic turn-on switching characteristics, Turn – off mechanism (Turn-off characteristics), Turn-off methods, Thyristor Ratings, Measurement of thyristor parameters, Comparison between Transistor and thyristor.

Unit 3
Gate Triggering Circuits: Introduction, Firing of Thyristors, Pulse Transformers, Optical isolators (optoisolators), Gate trigger circuits, Unijunction transistor, The programmable Unijunction transistor (PUT), Phase control using pedestal-and-Ramp Triggering, Microprocessor Interfacing to Power Thyristor.

Unit 4
Series and Parallel Operation Of Thyristor: Introduction, Series Operations of Thyristors, Need for Equalising network, Equalising network Design. Triggering of series connected thyristors, Parallel operation of thyristor, Method for ensuring proper current sharing, Triggering of thyristor in parallel, String Efficiency, Derating.

Unit 5
Power Semiconductor Decices: Introduction, Historical Perspective, Power semiconductor Devices, Phase Controlled Thyristors, Inverter- Grade Thyristors, Asymmetrical Thyristors (ASCR), Reverse Conducting Thyristors (RCT), Bidirectional Diode Thyristors (Diac), Bidirectional Triode Thyristors (TRIAC) , Silicon Unilateral switch(SUS), Silicon Bilateral switch(SBS), Silicon Controlled Switch(SCS), Light Activated Silicon- controlled Rectifiers (LASCR), Power MOSFETs, Insulated Gate Bipolar Trinsisters (IGBTs), Gate Turn-Off Thyristor (GTOs or Latching Transistors) Static induction Devices, MOS controlled Thyristor (MCT), Integrated Gate-commutated

Thyristor(IGCT), MOS Turn-Off Thyristors(MTO), Emitter Turn-Off Thyristors(ETO), Power Integrated Circuit (PICs), Comparison of power Devices, Silicon Carbide Devices.

Unit 6
Phase Controlled Converters: Introduction, Control Techniques, Single Phase Half-Wave Controlled Rectifier, Single Phase Full-Wave Controlled Rectifier(Two Quadrant Converters), Single Phase Half Controlled Bridge-Rectifier

1. *Recommended -Book*: Power Electronics" by Singh and Khanchandani, TMH Publication.
2. *Reference-Book:* "Power Electronics" by P.C. Sen, TMH Publication.
3. *Reference-Book:* "Power Electronics: Circuits, Devices and Application" by Rashid, Pearson Education.
4. *Reference-Book:* "Power Electronics" by B. R. Gupta and V. Singhal. Publisher: S. K. Kataria & Sons, New Delhi.

Paper 14: Fundamental of Communication Electronics

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Introduction: Introduction, The Communication Process, Source Of Information, Communication Channels, Baseband and Pass Band Signals, Representations of signal and systems, Classification of Communication, The Modulation Process, Primary communication Resources, Analog and Digital Communication, Advantages and Disadvantages of Digital Communication, Fundamental Limitations of communication system, Historical Perspective : The Evolution of Modern Electronic Communication.

Unit 2
Signal Analysis and Transmission: Introduction, Signal and Signal Classification, Singularity Functions, Representation of Signals, Fourier Series, Trigonometric Fourier Series, Properties of continuous time Fourier Series, Analysis of a Non Periodic Function over Entire Interval; Continuous time the Fourier Transform, Properties of Fourier Transform, Fourier Transform of Periodic Functions, Convolution, Energy Signal, Power Signal, Cross Correlation, Autocorrelation Function, Application of Fourier Transform to the analysis of LTI Networks, Concept of Distortion less Transmission through a System, Filters.

Unit 3
Amplitude-Linear Modulation: Introduction, Multiplexing, Amplitude Modulation, Modulation Index, Single Tone Amplitude Modulations(AM), Power Content in AM Wave, Transmission Efficiency of amplitude Modulated signal, Current Calculation for a single tone AM, Power Content in multiple tone amplitude modulation, Generation of amplitude modulation, Collector Modulation Method, Demodulation of AM wave, Double side Band Suppressed, Generation of DSB-SC Signal, Demodulation of DSB-SC Signals, Quadrature –Amplitude modulation, Effect of phase and Frequency Errors in Synchronous Detection, Carrier acquisition in DSB-SC System or synchronization technique in DSB-SC Systems, Single sideband suppressed carrier (SSB-SC)modulation, Hilbert Transform, SSB SC for a general modulating signal, Demodulation of SSB SC signals, Vestigial Sideband modulation systems, Generation of VSB signals, Demodulation of VSB signals, Comparison of various AM systems, Frequency translation and mixing.

Unit 4
Angle Modulation: Introduction, Concept of angle modulation: Basic Definition, Frequency Deviation, Relation Between PM and FM, Single tone Frequency modulation, Phasor Representation of angle modulation, Types of FM, Wideband FM, Effect of variation of modulation index mf on the spectrum of FM signal, Transmission bandwidth of FM signal, FM bandwidth for an arbitrary modulating signal x(t), Narrowband FM versus wideband FM, Multiple frequency modulation, Square wave modulation, linear

and nonlinear modulation, Phase modulation an analytic view, Comparison of angle modulated wave and amplitude modulates wave, Comparison of angle modulation and amplitude modulation, FM Generation, Drawback of direct method for FM generation, The indirect or Armstrong method of FM generation, Practical Armstrong method for FM generation, FM Demodulators or Detectors, Types of FM demodulators, Phase Difference Detectors.

Unit 5
Probability, Random Signals and Random process: Introduction, Basic definitions related to probability, probability, Properties of probability, probability of statistically independent events, Random variables, probability function or probability distribution of a direct random variable, cumulative Distribution Function (CDF), probability density function(PDF), joint cumulative Distribution Function, The joint probability Density function, Marginal Densities, Conditional probability density function, Statistical average of random variables, Uniform Distribution, Gaussian or normal distribution, Rayleigh Distribution, Random Process, Sum of Random Processes, Correlation Function, Spectral Densities, Response of Linear Systems to random inputs.

1. *Recommended-Book*: "Communication system (Analog and Digital)" By : Sanjay Sharma, S. K. Kataria & sons, New Delhi.
2. *Reference-Book:* "Communication Electronics" by Luis E. Fernando Jr. TMH Publication.
3. *Reference-Book:* "Electronic Communication Systems: Fundamental, Theory and Advance" by Tomasi, Pearson Education.
4. *Reference-Book:* "Electronic Communication Systems" by Kennedy and Davis, TMH Publication.

Paper 15: Op-Amp and Its Applications

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Introduction to Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation of a Typical Op-Amp, Analysis Of Typical Op-Amp Equivalent Circuit, Schematic Symbol, Integrated Circuits, Types of Integrated Circuits, Manufacturers' Designations for Integrated Circuits, Development of Integrated Circuits, Integrated Circuit Package Types, Pin Identification, and Temperature Ranges, Ordering Information, Device Identification, Power Supplies for Integrated Circuits. Introduction, Interpreting a Typical Set of Data Sheets, The Ideal Op-Amp, Equivalent Circuit of an Op-Amp, Ideal Voltage Transfer Curve, Open-Loop Op-Amp Configuration, PSpice Simulation, Introduction, Input Offset Voltage, Input Basic Current, Input Offset Current, Total Output Offset Voltage, Thermal Drift, Effect of Variation in Power Supply Voltages on Offset Voltage, Change in Input Offset Voltage and Input Offset Current with time, Other Temperature and supply Voltage Sensitive Parameters, Noise, Common-Mode Configuration and Common-Mode Rejection Ratio.

Unit 2
An Op-Amp with negative Feedback: Introduction, Block Diagram Representation of Feedback Configurations, Voltage-Series Feedback Amplifier, Voltage Shunt Feedback Amplifier, Differential Amplifiers, PSPICE Simulation.
Frequency Response of an Op-Amp: Introduction, Frequency Response, Compensating Networks, Frequency Response of Internally Compensated Op-Amps, Frequency Response of Noncompensated Op-Amps, High Frequency op-Amp Equivalent Circuit, Open Loop Voltage Gain as a Function of Frequency, Closed Loop Frequency Response, Circuit Stability, Slew Rate

Unit 3
General Linear Applications: Introduction, DC and AC Amplifiers, AC Amplifiers with a Single Supply Voltage, The Peaking Amplifier, Summing, Scaling, and Averaging Amplifier, Instrumental Amplifier, Differential Input and Differential Output Amplifier, Voltage to Current Convertor with Floating Load, Voltage to Current Convertor with Grounded Load, Current to Voltage Convertor, Very High Input Impedance Circuit, The Integrator, The Differentiator, PSpice Simulation.

Unit 4
Active Filters and Oscillators: Introduction, Active Filters, First-Order Low-Pass Butterworth Filter, Second-Order Low Pass Butterworth Filter, First-Order High Pass Butterworth Filter, Second Order High Pass Butterworth Filter, Higher Order Filters, Band-Pass Filters, Band-Reject Filters, All-Pass Filters, Oscillators, Phase Shift oscillator, Wien Bridge Oscillator, Quadrature Oscillator, Square Wave Generator,

Triangular Wave Generator, Sawtooth Wave Generator, Voltage Controlled Oscillator, PSpice Simulation.

Unit 5
Comparators, Convertors and Specialized IC Applications: Introduction, Basic Comparator, Zero-Crossing Detector, Schmitt Trigger, Comparator Characteristics, Limitations of Op-Amp as Comparator, Voltage Limiters, High Speed and Precision Type Comparators, Window Detector, Voltage to Frequency and Frequency to Voltage Convertors, Analog to Digital and Digital to Analog Convertors, Clippers and Clampers, Absolute Value Output Circuit, Peak Detector, Sample And Hold Circuit, PSpice Simulation. Universal Active Filters, Switched capacitor Filter, The 555 Timer, Phase Locked loops, Power Amplifiers, Voltage Regulators, PSpice Simulation.

1. *Recommended-Book*: "Op-Amps and Linear Integrated Circuits" by Gayakwad, Pearson Education.
2. *Reference-Book:* "Electronics devices and circuits" J.B. Gupta, S.K. Kataria and son's publication, New Delhi
3. *Reference*-Book: "Operational Amplifiers with Linear Integrated Circuits" by Stanley, Pearson Education.

Paper 16: Basic Instrumentation

Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1
Qualities of Measurements: Introduction, Performance Characteristics, Static Characteristics, Types of Static Error, Sources Of Errors, Dynamic Characteristic, Statistical Analysis, Standard, Automatic Frequency And Time Standards, Electrical Standards, Graphical Representation Of Measurements As Distribution.

Unit 2
Indicators and Display Devices: Basic Meter Movement, Taut band instrument, Electrodynamometer, Moving Iron Types Instruments, Concentric Vane Repulsion Instrument, Digital Display System and Indicators, classification of Displays, Display Devices, LED, LCD, Other Displays, Printers, Classification of Printers, Printer Character set, Drum Wheel, Line Printers, Drum Printers, Dot-Matrix Printers, Character at a Time Dot-Matrix Impact Printer, Non-Impact Dot-Matrix Printers.

Unit 3
Ammeters, Voltmeters and Multimeters: DC Ammeter, Multirange Ammeter, The Aryton Shunt or Universal Shunt, Requirements of a Shunt, Extending of Ammeter Ranges, RF Ammeter, Limitations of Thermocouples, Effect of Frequency on Calibration, Measurement of Very Large Currents by Thermocouples. Basic meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, Transistor Voltmeter, Chopper Type DC Amplifier Voltmeter, Solid State Voltmeter, Differential Voltmeter, DC Standard/Difference Voltmeter, AC Voltmeter using Rectifiers, AC Voltmeter Using Half Wave Rectifiers, AC Voltmeter Using Full Wave Rectifier, Multirange AC Voltmeter, Peak Responding Voltmeter, True RMS Voltmeter, True RMS Meter, Considerations in Choosing an Analog Voltmeter, Ohmmeter, Shunt Type Ohmmeter, Calibration of DC Instrument, Calibration of Ohmmeter, Multimeter, Multimeter Operating Instructions.

Unit 4
Digital Voltmeters and Digital Instruments: Introductions, Ramp Technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly Used Principles Of ADC, Successive Approximation, Continuous Balance DVM Or Servo Balancing, 3 1/2 Digit, Resolution And Sensitivity Of A DVM, General Specification Of A DVM, Microprocessor Based Ramp Type DVM. Digital Multimeters, Digital Frequency meter, Digital Measurement of time, Universal Counter, Decade Counter, Electronic Counter, Digital Measurement of frequency, Digital Tachomete, Digital pH Meter, Automation in Digital Instruments, Digital Phase meter, Digital capacitance meter, microprocessor based instruments, The IEEE 488 Bus.

Unit 5

Oscilloscope and Signal Generators: Basic Principle of CRO, CRT Features, Block Diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Triggered Sweep CRO, Trigger pulse Circuit, Delay Line in Triggered Sweep, Sync Selector for Continuous Sweep CRO, Typical CRT Connections, High Frequency CRT, Dual Beam CRO, Dual Trace Oscilloscope, Electronic Switch, sampling Oscilloscope, Storage Oscilloscope, Digital Readout Oscilloscope, Measurement of Frequency by Lissajous Method, Spot Wheel Method, Gear Wheel Method, Checking of Diodes, Basic Measurement of Capacitance and inductance, Oscilloscope as Bridge null Detector, Use of Lissajous Figures For Phase Measurement, Standard Specification fo Single Beam CRO, Probes for CRO, Attenuators, Applications of Oscilloscope, Delayed Sweep, Digital Storage Oscilloscope, Fibre Optic CRT Recording Oscilloscope, Oscilloscope Operating Precautions, Placing an Oscilloscope in Operation. Fixed Frequency AF Oscillator, Basic Standard Signal Generator, Standard Signal Generator, Modern Laboratory signal Generator, AF sine and square wave generator, Function Generator, Square and pulse Generator, Random Noise Generator, Sweep Marker Generator, Wobbluscope, Video Pattern Generator, Colour Bar Generator, Vectroscope, Beat Frequency Oscillator(BOF), Standard Specification of a Signal Generator.

1. *Recommended-Book*: " Electronic Instrumentation" by H S Kalsi, Second Edition, The McGraw-Hill Companies.
2. *Reference-Book:* "Electrical and Electronic Measurements and Instrumentation" by A K Sawhney. Dhanpat Rai & Sons publications.
3. *Reference-Book:* "Electronic Instruments and Instrumentation Technology" by Anand, PHI.
4. *Reference-Book:* "Electronic Instrumentation and Measurements: by Bell, PHI.
5. *Reference-Book:* "Instrumentation, Measurement and Analysis" by Nakra B. C. and Chaudhary K. K., TMH.

Set of 10 Experiments + One Project   **(Credit 08)**