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)

Department of Electronics
Saurashtra University Campus
Rajkot-360005
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www.saurashtrauniversity.edu
## SAURASHTRA UNIVERSITY
### DEPARTMENT OF ELECTRONICS
#### M.Sc. (ECI) SYLLABUS
##### SEMESTER I TO IV

### SEMESTER I

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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-mediands 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
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
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
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, microwave, 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.

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

Reference Books
1 Business Communication, Sinha K. K, S. Chand, 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

Unit 2

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

Reference Books
2. Circuit Theory by Iyer, Person Education.
3. Basic Circuit Theory by Hnelsman, PHI Publication
Paper 7: Introduction of Digital Electronics

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

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**

Reference Books
1. Design” by Morris Mano, PHI Publication
Unit 1

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

Reference Books
2. Electronic Devices by Floyd, Pearson Education.
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

Unit 2

Unit 3

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
Unit 6


Recommended-Book


Reference Books

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

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
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


Recommended-Book

Reference Books
1. Design” by Morris Mano, PHI Publication
Unit 1

Unit 2

Unit 3

Unit 4

Unit 5
Unit 6

Unit 7

Recommended-Book

Reference Books
2. Electronic Devices by Floyd, Pearson Education.
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

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.
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**


**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

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

Unit 5
Power Semiconductor Devices: 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 Transistors (IGBTs), Gate Turn-Off Thyristor (GTOs or Latching Transistors) Static induction Devices, MOS controlled Thyristor (MCT), Integrated Gate-commutated
Phasor Diagrams

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.
Paper 14: Fundamental of Communication Electronics

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

Unit 1

Unit 2

Unit 3

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 m\textsubscript{f} 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.

Unit 1

Unit 2

**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

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.

Paper 16: Basic Instrumentation
Credit: 04
Total Marks: 100 (70 External+30 Internal)
Total Hours requires: 60 Hrs.

Unit 1

Unit 2

Unit 3

Unit 4
Unit 5


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)