SCHEME OF INSTRUCTION

B.E. (ECE)

III - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	BS 303 MT	Mathematics – III	3	1	0	4	30	70	4
2	HS 901 MB	Managerial Economics and Accountancy	3	0	0	3	30	70	3
3	PC 301 EC	Electronic Devices and Circuits	3	0	0	3	30	70	3
4	PC 302 EC	Digital System Design	3	0	0	3	30	70	3
5	PC 303 EC	Signal Analysis and Transform Techniques	3	0	0	3	30	70	3
6	PC 304 EC	Network Analysis and Synthesis	3	0	0	3	30	70	3
Practicals									
7	PC 351 EC	Electronic Devices and Circuits Laboratory	0	0	2	2	25	50	1
8	PC 352 EC	Networks and Logic Design Laboratory	0	0	2	2	25	50	1
Total			**18**	**1**	**4**	**23**	**230**	**520**	**21**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
HS : Humanities and Social Sciences

SCHEME OF INSTRUCTION

B.E. (Service courses offered to other Departments)
III - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	ES 301 EC	Basic Electronics Engineering (CSE)	3	1	0	3	30	70	4
2	ES 302 EC	Applied Electronics (M.E)	3	0	0	3	30	70	3
3	PC 305 EE	Analog Electronics (EEE)	3	0	0	3	30	70	3
4	ES 307 EC	Electronic Circuits (BME)	3	0	0	3	30	70	3
5	ES 304 EC	Circuit Analysis (BME)	3	0	0	3	30	70	3
Practicals									
6	PC 351 CS	Basic Electronics Engineering Laboratory (CSE)	0	0	2	2	25	50	1
7	ES 351 EC	Analog Electronics Laboratory (EEE)	0	0	2	2	25	50	1
8	ES 352 EC	Electronic Circuits Laboratory (BME)	0	0	3	3	25	50	1
Total			**15**	**1**	**7**	**22**	**225**	**500**	**19**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BS : Basic Sciences
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BS 303 MT

Mathematics – III

(Partial Differential Equations and Numerical Methods)

Credits:4

Instruction: (3L +1T) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Apply general methodology to solve linear first order and second order partial differential equations*
- *To study the classification of second order partial differential equations and solve them by using separation of variables methods*
- *To introduce a few numerical methods to solve non linear equations and system of linear equations*
- *To provide the necessary basic concepts of numerical differentiation, numerical integration and differential equations*

Course Outcomes:

After completion of this course the students able to

- *Find solutions of the heat equation, wave equation, and the Laplace equation subject to boundary conditions*
- *Solve non linear equations, system of linear equations and differential equations numerically*
- *Perform numerical differentiation and numerical integration*

UNIT-I

Definition of Partial Differential Equations, First order partial differential equations, Solutions of first order linear PDEs, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

UNIT-II

Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation, Heat diffusion and vibration problems, Separation of variables method to Solve simple problems in Cartesian coordinates. The one-dimensional diffusion equation and its solution by separation of variables.

UNIT-III

Bisection method, Newton-Raphson method, Solution of linear system of equations- Gauss elimination method, LU decomposition method, Gauss-Jacobi and Gauss-Seidel iteration methods.

UNIT-IV

Interpolation, Lagrange’s interpolation, Newton’s divided difference interpolation, Newton’s Forward and Backward difference interpolations. Numerical differentiation, Interpolation approach, Numerical Integration-Trapezoidal rule, Simpson’s 1/3 rule.

UNIT: V

Taylor’s series method, Euler’s method, Picard’s method of successive approximations, Runge-Kutta method of 4th order.

Suggested Readings:

1. R.K.Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition 2014.
2. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition.
3. M.K.Jain,S.R.K.Iyengar and R.K.Jain, *Numerical methods for scientific and engineering computation* ,6th edition , New Age International Limited., 2012.
4. S.S.Sastry, *Introductory Methods of Numerical Analysis*, 5th edition , PHI Private Limited, 2012.

HS 901 MB

Managerial Economics and Accountancy

Credits:3

Instruction: 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To learn important concepts of Managerial Economics and apply them to evaluate business decisions.*
- *To understand various parameters that determine the consumer's behaviour.*
- *To evaluate all the factors that affect production.*
- *To understand the concepts of capital budgeting and payback period.*
- *To study the concepts of various book-keeping methods.*

Course Outcomes:

Student will be Able to

- *Apply the fundamental concepts of managerial economics to evaluate business decisions.*
- *Understand types of demand and factors related to it.*
- *Identify different types of markets and determine price-output under perfect competition.*
- *Determine working capital requirement and payback period.*
- *Analyze and interpret financial statements through ratios.*

UNIT – I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time perspective, Risk and Uncertainty, Profits, Case study method.

UNIT – II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked).

UNIT – III

Theory of Production and Markets: Production Function, Law of Variable Protection, ISO quants, Economics of Scale, Cost of Production (Types and their measurements), Concept of Opportunity cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price-Output determination under perfect Competition and Monopoly (Theory and problems can be asked).

UNIT – IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

UNIT – V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with sample adjustments, Analysis and interpretation of Financial statements through Ratios.
(Theory questions and numerical problems on preparation of final accounts, cash book, pretty cash book, bank reconciliations statement, calculation of some ratios).

Suggested Readings:

1. Mehta P.L., *Managerial Economics-Analysis, Problems and Cases,* Sulthan Chand & Sons Educational Publishers, 2011.
2. Maheswari S.N., *Introduction to Accountancy,* Vikas Publishing House, 2005.
3. Pnadey I.M., *Financial Management,* Vikas Publishing House, 2009.

PC 301 EC

Electronic Devices and Circuits

Credits:3

Instruction: 3L hrs per week *Duration of SEE: 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Study semiconductor physics and Analyze the behavior of Semiconductor diodes in Forward and Reverse bias*
- *Develop Half wave and Full wave rectifiers with L, C, LC & CLC Filters*
- *Explain V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations*
- *Design DC Biasing techniques and evaluate A.C parameters for BJT in Amplifier Applications*
- *Explore V-I characteristics of FETs, MOSFETs*

Course Outcomes:

- *Interpret the characteristics and apply diode models to analyze various applications of diodes*
- *Identify the merits and demerits of various filters, formulate and design rectifier circuits with filters Calculate ripple factor, efficiency and % regulation of rectifier circuits.*
- *Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability*
- *Analyze, compare and design of BJT amplifiers with various biasing circuits*
- *Distinguish the working principles of BJT and FET also between FET & MOSFET*

UNIT –I

Semiconductor Diode: Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of V-I characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics and Applications.

UNIT-II

Semiconductor Diode Applications: Half wave, Full wave and Bridge rectifiers – their operation, performance characteristics and analysis. Filters (L, C, LC and CLC filters) used in power supplies and their ripple factor calculations, design of Rectifiers with and without Filters.
Special Diodes (Qualitative Treatment only): Tunnel Diode, Varactor Diode, Schottky Diode, Light Emitting Diode, Photo Diode and Solar cells.

UNIT-III

Bipolar Junction Transistor: Transistor Junction formation (collector-base, base-emitter Junctions), Transistor biasing – band diagram for NPN and PNP transistors, current components and current flow in BJT, Ebers moll model, Modes of transistor operation, BJT V-I characteristics in CB, CE, CC configurations, BJT as an amplifier, BJT biasing techniques,

operating point stabilization against temperature and device variations, Bias stabilization and compensation techniques, Biasing circuits design.

UNIT-IV

Small Signal Transistors equivalent circuits: Small signal low frequency h-parameter model of BJT, Approximate model, Analysis of BJT amplifiers using Approximate model for CB, CE and CC configurations; High frequency - Π model, Relationship between hybrid -Π and h – parameter model.

UNIT-V

Junction Field Effect Transistors (JFET): JFET formation, operation & current flow, V-I characteristics of JFET,

MOSFETs: Enhancement & Depletion mode MOSFETs, current equation, V-I characteristics, DC-biasing, Low frequency small signal model of FETs. Analysis of CS, CD and CG amplifiers, MOS Capacitor.

Suggested Reading:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, “Electronic Devices and Circuits”, 3rd ed., Mc-Graw Hill Education, 2010.
2. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th ed., Pearson India Publications, 2015.
3. Salivahanan.S, Suresh Kumar.N “Electronic Devices and circuits”, 3rd edition, Tata McGraw-Hill, 2012.

PC 302 EC

Digital System Design

Credits:3

Instruction: 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives: *This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit. The main objectives are:*

- *To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.*
- *To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.*
- *To implement simple logical operations using combinational logic circuits and design of sequential logic circuits.*
- *To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.*
- *To implement synchronous state machines using flip-flops.*

Course Outcomes: Upon *completion of the course, students should possess the following skills:*

- *Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.*
- *Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.*
- *Be able to design and analyse small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.*
- *Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.*

UNIT-I

Number System and Logic Simplification: Number Systems, Base Conversion Methods and Complements of Numbers. Review of Boolean algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh map up to 5 variables, Tabular method.

UNIT-II

Combinational Logic Design: Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel Shifter, ALU, Comparators, Multiplexers, De-multiplexers, Encoder, Decoder, Driver & Display Devices, Code Converters.

UNIT-III

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK Flip-flops, D and T Flip-Flops. Ripple and Synchronous Counters, Shift Registers, Finite State Machines, Design of synchronous FSM, Algorithmic State Machine charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.

UNIT-IV

Logic Families: Design of TTL Logic family, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS Logic families and their interfacing. Logic implementation using PLDs-PROM, PAL and PLA. Introduction to CPLD and FPGA.

UNIT-V

Verilog HDL: Introduction to HDL, Verilog HDL Basics: Module Concept, Lexical Conventions, Value Set, Constants, Data Types, Primitives, Module modeling styles: Structural, Data flow and Behavioral.

Suggested Reading:

1. R.P.Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. M.Morris Mano, Michael D. Ciletti, "Digital Design", Pearson, 4th Edition, 2012.
3. Ming-Bo Lin, "Digital System Design and Practices Using Verilog HDL and FPGAs", Wiley India Pvt. Ltd., 2012.

PC 303 EC

Signal Analysis and Transform Techniques

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To learn basic concepts related to signals & systems.*
- *To familiarize with basic operations on signals mathematical representation of periodic aperiodic signals continuous discrete systems.*
- *To understand convolution, correlation operations on continuous signals.*
- *To analyze the response of systems on application of step, ramp inputs using Fourier & Z-transforms.*

Course Outcomes:

Students will be

- *Be able to describe signals mathematically and understand how to perform mathematical operations on signals.*
- *Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.*
- *Be able to compute the output of an LTI system given the input and impulse response through convolution sum and convolution integral*
- *Understand the sampling theorem and the process of reconstructing a continuous signal Random its samples*
- *Be able to solve a linear constant coefficient difference equation using Z transform techniques*

UNIT-I

Introduction to Signals & Systems: Classification of signals, Operations on signals, types of systems, Exponential and Trigonometric Fourier series, Dirichlet's condition.

UNIT-II

Fourier Transform: Representation of aperiodic signal, Introduction of Fourier transform, Convergence, properties of Fourier Transform, Fourier transform of periodic signals, Singularity function, Parseval's theorem, Energy spectral density, Development of Discrete Time Fourier transform, Convergence issues associated with the DTFT.

UNIT-III

Sampling: Sampling of continuous time signals, sampling theorem, Aliasing effect, reconstruction of a signal and its samples.

Convolution & Correlation of signals: Convolution integral, Properties of convolution, Graphical method of convolution, Convolution of Discrete time signals, overlap-add and overlap-save method of discrete convolution, Definition of correlation, Auto correlation, Properties of Autocorrelation, Cross correlation of signals.

UNIT-IV

Laplace Transform: Review of Laplace transforms, region of convergence and properties, poles and zeros, relation between Laplace and Fourier transforms, properties of Laplace transform, inverse Laplace transform, Solutions to differential equation and system behavior.

UNIT-V

Z Transform: Definition of Z-Transform, Properties of Z-Transform, Region of convergence of Z-Transform, Inverse Z Transform using Inspection, Partial fraction expansion, Power series Expansion, Contour integration methods, Parseval's relation analysis of discrete time systems using Z-Transform. Realization of discrete time system using Direct form, Cascade parallel forms.

Suggested Readings:

1. Alan V. Oppenheim, Alan.S.Willsky, S Hamid Nawab, *Signals and Systems*, 2nd edition, Prentice Hall of India, 2007.
2. Lathi B.P., *Signals Systems Communications*", 1st edition, B.S. Publications, 2006.
3. Simon Haykin and Van veen, "Signal and system", Willy, second edition.

PC 304 EC

Network Analysis and Synthesis

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To introduce basic circuit elements, their terminal characteristics, DC Circuit analysis techniques, RMS Average values of periodic signals, Network Theorems.*
- *To introduce the concepts of Two Port networks, study about the different two port parameter representations and principles of two port network parameters topologic description of networks*
- *To introduce the concepts of impedance, phase, phasor, resonance, complex frequency, Transient Analysis.*
- *To Analyze and Design different LC filters and Attenuators.*
- *To Design concepts of network synthesis.*

Course Outcomes:

Student will be

- *Able to Learn how to develop and employ circuit models for elementary electronic components and to adapt using various methods of circuit analysis, including simplified methods such as Series-parallel reductions, voltage and current dividers, superposition and Thevenin-Norton equivalent circuits etc.*
- *Able to Analyze given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits and how they are used in real time applications. Able to analyze the topologic description of networks. Ability to Solve Circuits using Tree, Node, Branch, Cutset, Tie Set Methods.*
- *Able to analyze small RLC circuits Series and parallel Resonance of RC, RL and RLC circuits. Able to solve Transient Analysis.*
- *Able to design different types of filters and Attenuator.*
- *Able to synthesize the RL, RC & RLC networks Foster and Cauer Forms.*

UNIT – I

Network Theorems: Circuit Elements, Dependent and Independent Sources, Passive Elements, R, L, C, Energy Stored in L, C, Wye-Delta transformation, Nodal and Mesh analysis, Tellegen's Theorem and Maximum Power Transfer Theorem.

Network Topology: Graph, Tree, Tie set, cut set matrix, Impedance matrix formulation of node loop equations using tie-set, cut-set analysis.

UNIT – II

Two port networks: Z, Y, h, g, ABCD parameters, equivalence of two ports, Condition for Symmetry and Reciprocity. T-PI transformations, inter connection of two ports networks, Brune's test for interconnection.

UNIT – III

Response of R, L, C Networks: DC and AC excitations of RL, RC and RLC circuits, Transient Analysis. Resonance-Series and parallel. Quality factor, Bandwidth of Resonant Circuits, Steady state sinusoidal analysis using phasors, active power, reactive power and power triangle.

UNIT – IV

Filters and Attenuators and Equalizers: Constant K filters, LP, HP, BPF, BSF, m-derived composite filter design, lattice filters. Symmetrical, Asymmetric T, PI sections networks, Characteristic Impedance, Image Impedances, Iterative Impedance and propagation constant. Design of Attenuators-Symmetrical T, Pi, Lattice and Bridge-T.

UNIT – V

Network Synthesis: Fosters reactance theorems, Positive real function, Hurwitz polynomial, Driving point Impedance and admittance. Synthesis of one port RC, RL and LC networks using Foster and Cauer forms.

Suggested Readings:

1. Van Valkenberg M.E, *Network Analysis,* 3rd edition, Prentice Hall of India, 1996
2. Hayt W H, Kemerly J E Durbin, *Engineering Circuit Analysis*, 7th edition, Tata McGraw Hill, 2006.
3. Smarajit Ghosh, *Network Theory Analysis and Synthesis,* PHI Learning private Limited,2013

PC 351 EC

Electronic Devices and Circuits Laboratory

Credits:1

Instruction : 2P per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *Study the characteristics of PN diode.*
- *Learn the characteristics of BJT in CE, CB and CC configurations.*
- *Plot characteristics of FET in CS and CD configurations.*
- *Observe the parameters of BJT and FET amplifiers.*

Course Outcomes:

- *Understand characteristics of Diodes*
- *Plot the characteristics of BJT in different configurations.*
- *Record the parameters of BJT and FET amplifiers.*
- *Understand biasing techniques of BJT.*
- *Use the SPICE software for simulating electronic circuits.*

List of Experiments

1. Measurement of static and dynamic resistances of Silicon and Germanium diodes.
2. Zener diode Characteristics and its application as voltage regulator.
3. Design, realization and performance evaluation of half wave rectifiers without and with filters.
4. Design, realization and performance evaluation of full wave rectifiers without and with filters.
5. Static characteristics of Bipolar-junction Transistor CB configuration
6. Static characteristics of Bipolar-junction Transistor CE configuration
7. Design of Self Bias Circuit
8. Drain and Transfer Characteristics of JFET
9. Design of JFET Common Source Amplifier
10. Design of Common Emitter BJT amplifier
11. Characteristics of UJT
12. Simulate any two experiments using PSPICE

Note: A minimum of 10 experiments should be performed

Suggested Reading:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text – Lab Manual*, 7th Edition, TMH 2001.

PC 352 EC

Networks and Logic Design Laboratory

Credits:1

Instruction : 2P per week *Duration of SEE : 3hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To design and test different theorems.*
- *To design and understand of two-port networks and resonance circuits.*
- *To Study of frequency response of LPF and HPF.*
- *To design combinational circuits and sequential circuits.*
- *To design counters and shift register.*

Course Outcomes:

Students will be

- *Able to analyse and verify Different Network theorems.*
- *Able to understand two-port networks and resonance circuits*
- *Able to calculate frequency response curves of LPF, HPF.*
- *Able to understand and verify truth table of combinational circuits and sequential circuits.*
- *Able to understand and verify counters and shift register.*

List of Experiments

1. Verification of Reciprocity and Tellegen's Theorems
2. Verification of Maximum Power Transfer and Superposition Theorems
3. Two-Port Parameters
4. Series and Parallel Resonance
5. Design of Constant K Low Pass and High Pass filter
6. Design of m-Derived low pass and high pass filter
7. Design Half Adder, Full Adder and 4-bit Parallel Adder
8. Design 3 to 8 Decoder using logic gates
9. Design and Application of Multiplexers
10. Implementation of flip-flops using logic gates
11. Design a Counter circuit
12. Design a Shift Register

Suggested Reading:

1. Hayt W H, Kemerly J E Durbin, *Engineering Circuit Analysis,* 7th edition, Tata McGraw-Hill, 2006.

2. M.Morris Mano, Michael D. Ciletti, "Digital Design", Pearson, 4th Edition, 2012.

Service Course

ES 301 EC

Basic Electronics Engineering (CSE)

Credits:4

Instruction : (3L+1T) hrs per week *Duration of SEE : 3hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To analyze the behavior of semiconductor diodes in Forward and Reverse bias.*
- *To design of Half wave and Full wave rectifiers with L,C, LC & CLC Filters.*
- *To explore V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.*
- *To explain feedback concept and different oscillators.*
- *To analyze Digital logic basics and Photo Electric devices.*

Course Outcomes:

Students will be

- *Able to learn about forward biased and reversed biased circuits.*
- *Able to plot the V-I Characteristics of diode and transmission.*
- *Able to design combinational logic circuits and PLDs.*

UNIT-I

Semi-Conductor Theory: Energy Levels, Intrinsic and Extrinsic Semiconductors, Mobility, Diffusion and Drift current. Hall Effect, Characteristics of P-N Junction diode, Parameters and Applications.

Rectifiers: Half wave and Full wave Rectifiers (Bridge, center tapped) with and without filters, ripple regulation and efficiency. Zener diode regulator.

UNIT-II

Bipolar Junction Transistor: BJT, Current components, CE, CB, CC configurations, characteristics, Transistor as amplifier. Analysis of CE, CB, CC Amplifiers (qualitative treatment only) .

JFET: Construction and working, parameters, CS, CG, CD Characteristics, CS amplifier.

UNIT-III

Feedback Concepts – Properties of Negative Feedback Amplifiers, Classification, Parameters. Oscillators – Barkhausen Criterion, LC Type and RC Type Oscillators and Crystal Oscillators. (Qualitative treatment only).

UNIT-IV

Operational Amplifiers – Introduction to OP Amp, characteristics and applications – Inverting and Non-inverting Amplifiers, Summer, Integrator, Differentiator, Instrumentation Amplifier.

Digital Systems: Basic Logic Gates, half, Full Adder and Subtractors.

UNIT-V

Data Acquisition Systems: Study of transducer (LVDT, Strain gauge, Temperature, and Force). Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics only.

Display Systems: Constructional details of C.R.O and Applications.

Suggested Readings:

1. Jocob Millman, Christos C. Halkias and Satyabrata Jit, *Electronics Devices and Circuits,*3rd Edition, McGraw Hill Education (India) Private Limited, 2010.
2. Rama Kanth A. Gaykward, *Op-AMPS and Linear Integrated Circuit*, 4thEdition Prentice Hall of India, 2000.
3. M. Morris Mano, *Digital Design*, 3rdEdition, Prentice Hall of India, 2002.
4. William D Cooper, and A.D. Helfrick, *Electronic Measurements and Instrumentations Techniques*, 2ndEdition, Prentice Hall of India, 2008.
5. S. Shalivahan, N. Suresh Kumar, A. Vallava Raj, *Electronic Devices and Circuits*, 2ndEdition., McGraw Hill Education (India) Private Limited, 2007.

ES 302 EC

Applied Electronics (ME)

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand the characteristics of diodes and transistor configurations*
- *To understand the design concepts of biasing of BJT and FET*
- *To understand the design concepts of feedback amplifiers and oscillators*
- *To study the design concepts of OP Amp and data converters*

Course Outcomes:

- *Study and analyze the rectifiers and regulator circuits.*
- *Study and analyze the performance of BJTs, FETs on the basis of their operation and working.*
- *Ability to analyze & design oscillator circuits.*
- *Ability to analyze different logic gates & multi-vibrator circuits.*
- *Ability to analyze different data acquisition systems*

UNIT-I

Characteristics of PN Junction: Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications

UNIT-II

Bipolar and Field Effect Transistors: Biasing FET, small signal model, h-parameter equivalent circuits, basic amplifier circuits-CB, CE, CC configurations of BJT and CG, CS and CD configurations of FETs, RC-coupled amplifier and its frequency response.

UNIT-III

Feedback Concepts: Types of negative feedback-modification of gain, bandwidth, input and output impedances-applications; Oscillators: RC phase shift, Wien bridge, LC and Crystal Oscillators.

UNIT-IV

Operational Amplifier: Characteristics, applications, Differential amplifiers, logic gate circuits-Introduction to Digital Systems-AND, NAND, NOR, XOR gates, Binary half adder, full adder, Multivibrators-Bi-stable, Mono-stable and Astable Multi-vibrators (Qualitative treatment only), Schmitt trigger.

UNIT-V

Data Acquisition Systems: Construction and Operation of transducers-Strain gauge LVDT, Thermocouple, Instrumentation Systems, Magnetic tape recorders, FM recording, Digital recording, Digital to Analog and Analog to Digital conversions.

***Suggested Reading*:**

1. Robert Boylestad L. and Louis Nashelsky, *Electronic Devices and Circuit Theory*, Prentice Hall of India , 2007
2. Helfrick D and David Cooper, *Modern Electronic Instrumentation and Measurements Techniques*, 1st edition, Prentice Hall of India, 2006.
3. Salivahanan, Suresh Kumar and Vallavaraj, *Electronic Devices and Circuits*, 2nd edition, Tata McGraw-Hill, 2010.

ES 305 EC

Analog Electronics (EEE)

Credits:3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand the diode characteristics.*
- *To study the input and out characteristics of different Transistor configurations.*
- *To understand the design concepts MOSFET and amplifier.*
- *To understand the design concepts of OP-Amp.*
- *To understand the Applications of OP-Amp.*

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- *Understand the characteristics of transistors.*
- *Design and analyse various rectifier and amplifier circuits.*
- *Design sinusoidal and non-sinusoidal oscillators.*
- *Understand the functioning of OP-AMP and design OP-AMP based circuits.*

UNIT I: **Diode circuits** (4 Hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

UNIT-II: BJT circuits (8 Hours)

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.

UNIT-III: MOSFET circuits (8 Hours)

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

UNIT-IV: Differential, multi-stage and operational amplifiers (8 Hours)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output off set voltage, input bias current, input offset current, slew rate, gain bandwidth product).

UNIT-V: Applications of op-amp (8 Hours)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion: (Flash, Successive Approximation, Dual slope).

Suggested Reading:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. D.Roy Chowdary and Shail B Jain, "*Linear Integrated Circuits*", 3rd Edition, New Age International (P) Limited, New Delhi, 2008.

ES 307 EC

Electronic Circuits (BME)

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *The course facilitates the students to study the principle and operation of Op-Amps.*
- *Exposure towards the applications of the Op-Amps.*
- *To know about the linear wave shaping circuits.*
- *The students also learn about Voltage regulators and SMPS.*

***Course Outcomes**:*

- *Understand and design the concept of Oscillators.*
- *Illustrate Operational amplifiers and their internal devices, including BJT and MOSFET transistors.*
- *Examine different applications of OP-AMPs with design examples.*
- *Design linear wave shaping circuits and higher order filters.*
- *Outline the basic concept of Power supply and SMPS.*

UNIT I:

Sinusoidal Oscillators Condition for oscillations – LC Oscillators – Hartley, Colpitts, Frequency and amplitude stability of oscillators – Crystal Oscillators – RC Oscillators – RC phase shift and Wien bridge oscillators.

UNIT II:

Operational Amplifiers Concept of Direct Coupled Amplifiers. Differential Amplifier-Calculation of common mode Rejection ratio, Differential Amplifier supplied with a constant current source, Normalized Transfer Characteristics of a differential Amplifier. Ideal Characteristics of an operational Amplifier and Parameters of an Op-Amp.

UNIT III:

Applications of Operational Amplifier Inverting and Non-inverting Amplifiers, Summing, scaling and Averaging amplifiers, Integrators, Differentiators, Logarithmic Amplifiers, Instrumentation Amplifiers, Rail-to-Rail op-amps, Voltage to Current and Current to Voltage Converters, Precision Rectifiers, Peak Detectors. Comparators, Schmitt trigger, Multivibrators, Sinewave oscillators (phase-shift and Wien bridge), Waveform generators (triangular and saw tooth), 555 Timers.

UNIT IV:

Linear wave shaping circuits & Filters Clipping circuits for single level and two level, Clamping circuit and applications.

Butterworth Filters: Active low pass Filter, High pass filter, Band pass filter, Band elimination filter & Notch filter. Higher order Filters and their Comparison. Design of second, fourth and sixth order filters using op-amps. Switched Capacitance Filters.

UNIT V:

Voltage Regulators & SMPS Linear power supply (voltage regulators); Basic Transistorized regulators, three pin regulators, switching voltage regulators; Review of basic dc-dc voltage regulator configurations -Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode.

Working principle of SMPS, Block Diagram of SMPS, Design criteria for SMPS, comparison of linear & switching power supply.

Suggested Reading:

1. Ramakanth A Gayakwad, *Op-Amps and Linear ICs*, 4th Edition, PHI, EE Edition, 2013.
2. R.F Coughlin and F.F Driscoll, *Op-Amps and Linear Integrated Circuits*, PHI, EE Edition, 4th Edition.2001.
3. JB Gupta, Electronic Devices and Circuits, S.K Kataria & sons, 5th Edition, 2012.

ES 304 EC

Circuit Analysis (BME)

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Students are exposed to analysis of physical circuits through the use of Kirchhoff's laws and ideal circuit element models.*
- *Strong emphasis is placed on the formulation of nodal equations for linear circuits as a foundation Transient analysis of second order circuits with unit step inputs and switched dc sources is emphasized to promote understanding of time-domain linear circuit response.*
- *Finally, students will master concepts of coupled inductors and transformers.*

Course Outcomes:

- *To understand the circuit elements and estimation of circuit parameters by different theorems.*
- *To analyze the RLC circuits for different types of inputs*
- *To derive the circuit parameters of RLC networks for different types of excitations.*
- *To estimate Laplace transforms and use it for circuit analysis*
- *To convert the network into graph and analyse it by network topology*

UNIT-I

Circuit elements, Dependent and independent sources, passive elements, R, L and C, Energy stored in L and C, Kirchoff's laws, integro-differential equations, RMS and average value of periodic signals, Network theorems: Superposition, Thevenin's, Norton's, Millman's and Maximum transfer theorem.

UNIT-II

Response of RC, RL and RLC circuits first order and second order differential equations, initial conditions, step response, in pulse response zero state and zero-input response, steady state and transient response**.**

UNIT-III

Response of RLC networks to exponential excitation, quality factor, damping ratio, Bandwidth of resonant circuits, sinusoidal excitation, steady state response, impedance and admittance functions, responses related to S-Plane location of roots.

UNIT-IV

Circuit analysis using Laplace Transforms, basic theorems of Laplace transforms, Laplace transform of periodic signals, unit, step, ramp and impulse functions, initial and final value theorems, solutions using Laplace transforms.

UNIT-V

Network Topology, Graph, tree, Tie set and cut set matrix, impedance matrix formulation of node and loop equations using Tie set and cut set.

Suggested Reading:

1. Valkenberg M.E Van, *Network Analysis*, PHI, New Delhi, 1996
2. Hayt W H, Kemerly J E and Durbin, *Engineering Circuit Analysis*, Tata McGraw-Hill-2006
3. Choudary Roy D, *Network and Systems*, New Age India, 1999

ES 351 EC

Basic Electronics Engineering Laboratory (CSE)

Credits:1

Instruction : 2p hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To understand the diode characteristics.*
- *To study the input and out characteristics of different Transistor configurations.*
- *To understand the design concepts of amplifier and Oscillator circuits.*
- *To understand the design concepts of feedback amplifiers.*

Course Outcomes:

Students will be

- *Able to design diode circuits.*
- *Able to understand the applications of Zener diode.*
- *Able to understand the operation of HWR & FWR circuits with & without filters.*
- *Able to analyze the characteristics of BJTs and FETs.*
- *Able to analyze the performance of operation amplifier.*
- *Able to operate laboratory equipment and analyze the results.*
- *Able to design logic gates using BJTs.*

List of Experiments:

1. CRO Applications.
2. Characteristics of semiconductor diodes (Ge, Si and Zener).
3. Static Characteristics of BJT (CE).
4. Static Characteristics of BJT (CB).
5. Ripple and Regulation characteristics of Half-wave rectifiers with and without filters.
6. Ripple and Regulation characteristics of Full-wave rectifiers with and without filters
7. Transistor as an amplifier.
8. Operational Amplifier Applications.
9. Emitter follower and source follower.
10. Static characteristics of CS configuration of FET.
11. BJT biasing.
12. Finding h-parameters for a two-port network (transistor in CB configuration).
13. Simulations of above experiments must also be carried using P-Spice Software.

Suggested Readings:

1. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India, 2007

ES 352 EC

Analog Electronics Laboratory (EEE)

Credits:1

Instruction : 2p hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To understand the diode characteristics.*
- *To study the input and out characteristics of different Transistor configurations.*
- *To understand the design concepts of amplifier.*
- *To understand the design concepts of Combinational and Sequential circuits.*
- *To understand the design concepts of OP-Amp.*

Course Outcomes:

Students will be

- *Able to design diode circuits.*
- *Able to understand the applications of Zener diode.*
- *Able to understand the operation of HWR & FWR circuits with & without filters.*
- *Able to analyze the characteristics of BJTs and FETs.*
- *Able to analyze the performance of operation amplifier.*

List of Experiments:

1. Characteristics of Semiconductor Diodes(Si, Ge and Zener).
2. Characteristics of BJT (CB, CE).
3. CRO and its Applications.
4. Rectifiers: Half Wave Rectifier, Full Wave Rectifier with and without filters
5. Characteristics of FET.
6. Transistors as an Amplifier.
7. Inverting, Non-Inverting Amplifier using Op amp.
8. RC phase shift Oscillator
9. Wien Bridge Oscillator
10. Integration and Differentiation using Op-amp.

Suggested Readings:

1. David Bell A., *Operational Amplifiers and Linear ICS,* Prentice Hall of India, 2005.
2. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.

ES 353 EC

Electronic Circuits Laboratory (BME)

Credits:1

Instruction : 3p hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *The course facilitates the students to design the Oscillators.*
- *To study the operation of Op-Amps.*
- *Exposure towards the applications of the Op-Amps.*
- *To know about the linear wave shaping circuits.*
- *The students also learn about Voltage regulators and SMPS.*

***Course Outcomes**:*

- *Build LC and RC Oscillators.*
- *Illustrate different applications of Operational amplifiers.*
- *Design the 3-Op-Amp Instrumentation amplifier.*
- *Construct linear wave shaping circuits and higher order filters.*
- *Demonstrate the Current sources.*

1. RC Coupled Amplifiers (Frequency response of BJT & FET)
2. Oscillators:
   a) Wein Bridge Oscillator
   b) RC Phase Shift Oscillator
   c) Hartley Oscillator
   d) Colpitts Oscillator
3. Op-Amps based Filters
   a) Active Low Pass Filters
   b) Active High Pass Filters
   c) Band Pass Filters
   d) Notch Filters
4. Wave Shaping Circuits using operational amplifiers:
   a) Differentiator
   b) Integrator
   c) Clipper
   d) Clamper
5. Differential amplifier
6. Instrumentation amplifier (INA112 & 3op-amp)
7. 555 Timer Applications:
   a) Astable Multivibrator
   b) Monostable Multivibrator
   c) Bistable Multivibrator
8. Current Sources
   a) Precision DC Current sources
   b) Voltage to Current Converters (ac & dc)
   c) High Frequency Current sources

SCHEME OF INSTRUCTION

B.E. (ECE)

IV - SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 401 EC	Analog Electronic Circuits	3	0	0	3	30	70	3
2	PC 402 EC	Probability Theory and Stochastic Processes	3	0	0	3	30	70	3
3	PC 403 EC	Electromagnetic Waves and Transmission Lines	3	0	0	3	30	70	3
4	PC 404 EC	Pulse and Integrated Circuits	3	0	0	3	30	70	3
5	PC 405 EC	Computer Architecture and Organization	3	0	0	3	30	70	3
6	ES 401 ME	Elements of Mechanical Engineering	3	0	0	3	30	70	3
7	MC 201 HS	Environmental Science	2	0	0	2	30	70	0
Practicals									
8	PC 451 EC	Analog Electronic Circuits Laboratory	0	0	2	2	25	50	1
9	PC 452 EC	Pulse and Integrated Circuits Laboratory	0	0	2	2	25	50	1
Total			**20**	**0**	**4**	**24**	**260**	**590**	**20**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BS : Basic Sciences
PC : Professional Core
PW : Project Work

SCHEME OF INSTRUCTION

B.E. (Service courses offered to other Departments)
IV - SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	ES 401 EC	Digital Electronics (BME)	3	0	0	3	30	70	3
Practicals									
2	ES 451 EC	Digital Electronics Laboratory (BME)	0	0	3	3	25	50	2
3	ES 452 EC	Applied Electronics Laboratory (M.E)	0	0	2	2	25	50	1
Total			**3**	**0**	**5**	**8**	**80**	**170**	**6**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
HS : Humanities and Social Sciences

PC 401 EC

Analog Electronic Circuits

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Analyze frequency response of Amplifiers in different frequency ranges.*
- *Familiarize with concept and effect of negative feedback*
- *Study positive feedback and Design different types of oscillators.*
- *Design Power Amplifiers and calculate their efficiencies.*
- *Familiarize with concept of tuned Amplifiers.*

Course Outcomes:

- *Design and Analyze low frequency, mid frequency and high frequency response of small signal single stage and Multistage RC coupled and Transformer Amplifiers using BJT and FET.*
- *Identify the type of negative feedback, Analyze and design of negative feedback amplifiers.*
- *Design Audio Frequency and Radio Frequency oscillators*
- *Distinguish between the classes of Power Amplifiers and their design considerations.*
- *Compare the performance of single and double Tuned Amplifiers.*

UNIT-I

Small Signal Amplifiers: Introduction to Hybrid-π model, relationship between hybrid-π & h-parameter model; Classification of amplifiers, mid-frequency, Low-frequency and high frequency analysis of single and multistage RC coupled amplifier with BJT and FET. Analysis of transformer coupled amplifier in mid frequency, Low frequency and high frequency regions with BJT.

UNIT-II

Feedback Amplifiers Analysis and Design: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations, Local Versus global feedback.

UNIT-III

Oscillators Analysis and Design: Positive feedback and conditions for sinusoidal oscillations, RC oscillators, LC oscillators, Crystal oscillator, Amplitude and frequency stability of oscillator.
Regulators: Transistorized series and shunt regulators.

UNIT-IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push-pull audio power amplifiers under Class-A. Class-B, Class D and Class-AB operations.

UNIT-V

RF Voltage Amplifiers: General consideration, Analysis and design of single tuned and double tuned amplifiers with BJT, Selectivity, gain and bandwidth. Comparison of multistage, single tuned amplifiers and double tuned amplifiers. The problem of stability in RF amplifiers, neutralization & uni-laterisation, introduction to staggered tuned amplifiers.

Suggested Reading:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, Electronic Devices and Circuits, 3rd ed., McGraw Hill Education, 2010.
2. David A. Bell, Electronic Devices and Circuits, 5th ed., Oxford University Press, 2009.
3. S Salivahanan, N Kumar, and A Vallavaraj, Electronic Devices and Circuits, 2nd ed., McGraw Hill Education, 2007.
4. Jacob Millman, Christos Halkias, Chetan Parikh, Integrated Electronics, 2nd ed., McGraw Hill Education (India) Private Limited, 2011.
5. Donald L Schilling & Charles Belove, Electronics Circuits, Discrete & Integrated, 3rd ed., McGraw Hill Education (India) Private Limited, 2002.

PC 402 EC

Probability Theory and Stochastic Processes

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand different types of Random variables their density distribution functions.*
- *To learn one Random variable characteristic functions of different variables using their density functions.*
- *To learn the concepts of sequences of Random variables, Properties of Random vectors.*
- *To understand elementary concepts of the Random Processes or distribution functions.*
- *To understand the functions of two Random variables probability density distribution of the joint Random variables.*

Course Outcomes:

Student will be

- *Able to solve using an appropriate sample space by the concepts of probabilities and understand multiple random variables, relate the same through examples to real problems.*
- *Able to Understand the usefulness of stochastic processes in their professional area.*
- *Able to Characterize the response of LTI systems driven by a stationary random process using autocorrelation and power spectral density functions.*
- *Able to Application of these principles in areas where presence of noise is a serious challenge.*

UNIT-I

Concepts of Probability Random Variable: Definitions, Probability Induction, Causality versus Randomness, Review of Set Theory, Probability Space, Conditional Probability. Repeated Trials Combined Experiments, Bernoulli Trials, Bernoulli's Theorem Games of Chance. Random Variable: Definition, Distribution Density Functions, Specific Random Variables their probability density distribution functions: Normal, Exponential, Gamma, Chi-Square, Raleigh, Nakagami-m, Uniform, Beta, Cauchy, Laplace Maxwell, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial Conditional Distributions, Asymptotic Approximations for Binomial Random Variable.

UNIT-II

Functions of One Random Variable: Function of a Random Variable $g(\mathbf{x})$, The Distribution of $g(\mathbf{x})$, Mean, Variance, Moments Characteristic Functions of Random variables with the above distributions.

UNIT -III

Two Random Variables: Bi-variate Distributions, One Function of Two Random Variables, Two Functions of Two Random Variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values.

UNIT-IV

Sequences of Random Variables: General Concepts, Conditional Densities, Characteristic Functions, Normality, Mean Square Estimation, Stochastic Convergence Limit Theorems. Random Numbers. Applications of Random numbers.

UNIT-V

Stochastic Processes: General elementary concepts definitions of stationary, ergodic, Random processes independence, spectral density, white color noise, response to linear systems stochastic inputs, Markov Processes.

Suggested Readings:

1. A Papoulis, S.U. Pillai, "Probability, Random Variables Stochastic Processes", 4th edition, Tata McGraw-Hill, 2008.
2. Peyton Z Peebles, "Probability, Random Variables & Random Signal Properties", 4th edition, Tata McGraw-Hill, 2001.
3. Richard H. Williams, "Probability, Statistics, Random Processes for Engineers", Thomson Learning, 1st edition, 2003.

PC 403 EC

Electromagnetic Theory and Transmission Lines

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To become familiar with the fundamental concepts of electrostatics and magneto statics laws their applications.*
- *To familiar with the four Maxwell's equations used to study time varying EM or dynamic fields to apply them to solve practical EM problems.*
- *To acquaint with theoretical analysis of the characteristics of electromagnetic waves in a wide variety of Practical Mediums.*

Course Outcomes:

Students will be

- *Able to express and elaborate Maxwell's Equations in differential and integral forms and the constitutive relations between the flux densities and field intensities of the electrostatics, magneto-statics and electrodynamics fields.*
- *Able to derive the Helmholtz wave equations in its various forms and the wave nature of their solutions for time-harmonic waves in various mediums.*
- *Able to apply fundamental electromagnetic concepts in applications such as Transmission Lines and Antennas.*

UNIT-I

Electrostatics: Review of Vector Calculus and Coordinate systems and Transformation, Coulomb's Law, Electric Field Intensity, Electric field due to different charge distributions - Electric Field due to Line Charge, Sheet Charge and Volume Charge Distribution. Electric Flux, Flux Density, Gauss's Law and Applications. Energy and Potential, Potential Field of a Point Charge, System of Charges, potential gradient, Energy density in Electrostatic fields, Electric Dipole, convection and conduction currents, continuity equation and relaxation time, Poisson's and Laplace's Equations, Capacitance and Capacitors.

UNIT-II

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law, Applications of Ampere's Law, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to magnetic fields, Magnetic Dipole, Magnetization, Inductors and Inductances, Magnetic Energy.

UNIT-III

Time Varying Fields and Maxwell's Equations: Faraday's Law, Transformer and Motional EMF's, Displace Current, Maxwell's Equations in Differential and Integral Forms, Time-Varying Potentials, Electromagnetic Boundary Conditions, Time-Harmonic Fields.

UNIT-IV

EM Wave Propagation: Uniform Plane Wave, Wave Propagation in Free Space, Dielectrics, Good Conductors-Skin Effect. Poynting's Theorem and Wave Power, Poynting Vector, Instantaneous, average and complex pointing vector, Wave Polarization-Linear, Circular and Elliptical polarizations, Reflection of Uniform Plane Waves at Normal incidence and Oblique incidence angles, Reflection coefficient, Transmission coefficient, power and energy calculations.

UNIT-V

Transmission Lines: Circuit representation, Equations of voltage and current on transmission line, propagation constant and characteristic impedance, Lossless Line, Distortion less Line, Infinite line concepts, Input impedance relations of open and short-circuited transmission lines, reflection coefficient and VSWR. The Smith Chart, Transmission Line Impedance Matching-Impedance Matching by Quarter wave Transformer, Single Stub Matching and Double Stub Matching.

Suggested Readings:

1. Matthew N,O. Sadiku, *Principles of Electromagnetics*, Oxford University Press, 2009, 4th edition.
2. David K.Cheng, *Field and Wave Electromagnetics*, Pearson Education, 2001, 2nd edition.
3. W.H.Hayt,Jr. and J.A Buck, *Engineering Electromagnetics*, Tata McGraw-Hill, 2006, 7th edition.

PC 404 EC

Pulse and Integrated Circuits

Credits:3

Instruction : 3L hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Analyze the behavior of Linear and non-linear wave shaping circuits*
- *Understand the operation of OP-AMP and its internal circuits*
- *Understand various digital ICs*
- *Analyze the applications of OPAMP and 555 Timer*
- *Explain the operation of various data converter circuits.*

Course Outcomes:

- *Construct different linear networks and analyze their response to different input signals*
- *Understand, Analyze and design multi vibrators and sweep circuits using transistors.*
- *Analyze DC and AC characteristics for Single/Dual input Balanced/Unbalanced output configurations using BJTs.*
- *Distinguish various linear and non-linear applications of Op-Amp.*
- *Analyze the operation of the most commonly used D/A and A/D converter types.*

UNIT- I

Linear Wave Shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe.

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independent levels. Clamping operation and Clamping circuit theorem.

UNIT-II

Differential amplifiers: Classification, DC and AC Analysis of Single/Dual input Balanced and Unbalanced output configurations using BJTs. Level Translator.

Operational Amplifier: OP AMP Block diagram, ideal Op-amp characteristics, features, parameters and their Measurement, Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR, Frequency response and Compensation Techniques.

UNIT-III

OPAMP Applications: Inverting and Non-inverting Amplifiers, Integrator and differentiator, summing amplifier, precision rectifier. Active filters: Low pass, high pass, band pass and band stop.

UNIT-IV

Digital Logic families: characteristics of digital ICs, RTL, TTL family IC's, characteristics and comparison among various series of TTL Family IC's, ECL family-operation and characteristics, CMOS logic family, comparison among CMOS series, Interfacing TTL and CMOS IC's

UNIT-V

555 Timer: Functional Diagram, Monostable, Astable and Schmitt Trigger Applications.

Voltage regulators: Fixed and variable voltage regulators (78XX and 79XX).

Data Converters: Digital-to-analog converters (DAC): Weighted resistor, inverted R-2R ladder, Analog-to-digital converters (ADC): dual slope, successive approximation, flash type. Specifications of Data Converters.

Suggested Reading:

1. J. Millman and H. Taub, Pulse, Digital and Switching Waveforms - McGraw-Hill, 1991.
2. David A. Bell, Solid State Pulse circuits - PHI, 4th Edn., 2002.
3. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
4. D.Roy Chowdhury, Shail B.Jain, "Linear Integrated Circuits", 4/e, New / Age International (P) Ltd., 2008.
5. Ramakanth A Gayakwad, ―Op-Amps and Linear Integrated Circuits‖, 3rd Edition, Prentice-Hall of India Limited, New Delhi, 1995.

PC 405 EC

Computer Architecture and Organization

Credits: 3

Instruction: 3L hrs per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Course Objectives:

- *To familiarize with Central Processing Unit (CPU) concepts.*
- *To understand register, architecture, addressing modes and instruction set of Intel microprocessor*
- *To design data path and control units of Central Processing Unit (CPU)*
- *To know IO processor and cache memory organization.*
- *To understand CPU performance enhancement strategies.*

Course Outcomes:

- *Design Arithmetic and Logic Unit for the given specifications.*
- *Develop programs of Intel Microprocessor*
- *Demonstrate data path and control unit realizations of CPU.*
- *Analyze replacement policies in cache memory organization*
- *Incorporate pipeline concept in a Central Processing Unit (CPU).*

UNIT-I

CPU Organization: Common bus structure, Arithmetic, Logic and Shift Unit using multiplexer, Register, Instructions, Design of CPU. Example: Intel 8085 – Programming model, Addressing modes, overview of Instruction set, Design of flowchart for CPU operation.

UNIT-II

Data Path Design: Fixed-Point Arithmetic: Addition, Subtraction, Multiplication -Robertson's, Booth's algorithms, Array Multiplier and Wallace tree multiplication, Division - Restoring and Non-restoring algorithms, floating point arithmetic and BCD Adder, Shifter: Barrel shifter and Logarithmic shifter, Examples: HDL descriptions of Fixed-Point and Floating-Point arithmetic.

UNIT-III

Control Design: Basic concepts, Hardwired Control unit design approach: classical and one-hot methods, Micro-programmed Control unit approach: basic concept, micro-program sequencer, Design examples: control unit designs for GCD processor, DMA controller and CPU control unit.

UNIT-IV

Memory and System Organization: Memory Organization: Memory hierarchy, Main memory: RAM, ROM, DRAM, Multi-level memory, cache memory: principles, address mapping techniques, replacement policies, System Organization: communication methods, IO and system control: Programmed IO, DMA and interrupts and Input-Output Processor (IOP), Examples: Three-level cache hierarchy in Intel Pentium Processor.

UNIT-V

Advances in Computer Organization: Reduced Instruction Set Computer (RISC): characteristics and architecture, Parallel processing: Pipeline – Arithmetic and Instruction, Pipeline Conflicts, Instruction Level Parallelism: super-pipeline, super-scalar architectures.

Suggested Reading:

1. Morris Mano M, *Computer System Architecture*, 3rd edition, Prentice Hall India, 2007.
2. William Stallings, *Computer Organization and Architecture, Design for Performance*, 7th edition, Prentice Hall India, 2006.
3. John P. Hayes, *Computer Architecture and Organization*, 3rd edition, McGraw Hill, 1998.

ES 401 ME

Elements of Mechanical Engineering

Credits: 3

Instruction: 3L hrs per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Course Objectives:

- *To understand basic concepts of thermodynamics.*
- *To understand practical application of thermal engineering concepts in various energy consumption and energy conversion systems*
- *To understand the working principles of I.C. engines, Reciprocating compressors and Refrigeration systems*
- *To familiarize the design and working principles of transmission drive systems.*
- *To understand various manufacturing processes.*

Course outcomes:

After completion of the course, students will be able to

- *Differentiate between heat and work transfers and relates them with enthalpy changes*
- *Formulate various power cycles, represents them on p-V, T-S diagrams and also study their feasibility in practical applications*
- *Understand the work saving methods in functioning of Compressors and refrigeration cycles*
- *Design belt drives and gear drives and formulate methods for balancing of rotating masses*
- *Demonstrate the working of various welding processes and gain knowledge of working of unconventional methods of manufacturing.*

UNIT- I

Statements of zeroth law, 1st, 2nd and 3rd Laws of thermodynamics with their applications. Representation of thermodynamic processes on p-V and T-s plots. Ideal gas equation. Relations for internal energy and entropy changes, heat and work transfers for closed systems. Steady flow energy equation for an open systems-derivation and applications in turbines, compressors, nozzles and diffusers. Relations for enthalpy changes, heat and work transfers for open systems.

UNIT-II

Power Cycles: Concept of air standard cycles- Carnot cycle, Otto, Diesel, Joule cycles with applications. Representation of Cycles on P-V and T-s plots. Calculation of Cycle efficiencies.

IC Engines: Classification of IC Engines. Mechanical components of IC Engines. Working Principles of four stroke and two stroke cycle engines. Differences between petrol and diesel engines. Calculation of engine parameters -IP, BP, Specific fuel consumption, mechanical and thermal efficiencies.

UNIT-III

Working principles of reciprocating air compressors-single and double acting, single stage and two stage. Effect of clearance. Conditions for maximum efficiency. Isentropic and isothermal efficiencies. Problems on work input, power required and efficiencies of single and two stage compressors. Methods for improving efficiency –use of intercooler and after cooler.

Refrigeration: Working of vapour compression refrigeration system and window Air conditioners. COP calculation. Common refrigerants in use, environmental impacts of refrigerants.

UNIT-IV

Belt drives: Velocity ratio, effect of slip. Length of open and cross belts. Ratio of tensions, centrifugal tension and its effect on power transmission. **Gear drives**: Nomenclature and types of gears. Problems on simple and compound gear trains. **Governors**: Working of Watt, Porter and Hartnell governors. Effect and power of governor. Stability of governor and isochronism. Balancing of several masses in one plane and in several planes.

UNIT- V

Production Techniques: Principles of Arc, Gas and Resistance welding, soldering and Brazing, working mechanism of Lathe, milling and drilling machines by simple sketches. Working principle of NC machines. Basic principles of USM, EDM, LBM and ECM. Principles of sand casting and die casting. Plastics and their moulding methods.

Suggested Reading

1. R.K. Rajput, "*Thermal Engineering*", Laxmi Publications, New Delhi, Eighth Edition, 2010.
2. P.K. Nag, " *Basic and Applied Thermodynamics*", Tata Mc-Graw Hill, Eigth Reprint, 2006.
3. Thomas Bevan, "*Theory of Machines*", College Book Store (CBS) Publishers, 3rd Edn., 1986.
4. Hajra Choudary, "*Elements of Workshop Technology-Vel. I and 2*, Asian Publishers, 6th Edn., 1993.
5. P. N. Rao, "*Manufacturing Technology*", Vol. I &2, Tata McGraw- Hill, 2nd Edn., 2009.

MC 201 HS

Environmental Science

Credits: 0

Instruction: 2L hrs per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

Course Objectives:

- *To know the Natural resources and their importance.*
- *To understand and realize significance of Ecosystems and Biodiversity.*
- *To understand the types of pollution, abatement practices and Disaster Management.*
- *To sensitize the students, about the global issues, mitigation techniques.*
- *To built the awareness regarding sustainable future.*

Course Outcomes:

- *Rational utilization of natural resource can be expected.*
- *Protection and conservation of ecosystems and biodiversity.*
- *Development of New technologies for the abatement of pollution.*
- *Mitigative techniques will come from the students.*
- *Sustainability can be achieved.*

UNIT-I

Environmental studies: Definition, scope and importance, need for public awareness. Natural resources: Water resources use and exploitation of Surface and Ground water. Floods, Drought, Conflicts over water, Dams-merits and demerits.
Land Resources: Land as a resource, Effects of modern Agriculture, Fertilizer-pesticide problems, Water logging and Salinity, land degradation, soil erosion and Desertification.
Energy resources: Growing energy needs, renewable and non-renewable energy resources.

UNIT-II

Ecosystems and Biodiversity: Concept of Ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, food web, ecological pyramids, aquatic ecosystem (ponds, lakes, streams, rivers, oceans, estuaries)
Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

UNIT-III

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, Thermal pollution. Solid waste management, Municipal solid waste management, Biomedical waste management and, hazardous wastemanagement.
Disaster management: Types of disasters, impact of disasters on environment, infrastructure, and development.

UNIT-IV

Environmental protection and Global issues: Environmental protection acts: Air, Water, Forest and wild life Acts, enforcement of Environmental legislation. Water conservation, watershed management, and Environmental ethics. Climate change, Global warming, acid rain, ozone layer depletion.

UNIT-V

Sustainable future: Concept of Sustainable Development, Sustainable development goals, Population and its explosion, Crazy Consumerism, Urban Sprawl, Environmental Education, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

Suggested Readings:

1. De A.K., *"Environmental Chemistry"*, Wiley Eastern Ltd., 1989.
2. Odum E.P., *"Fundamentals of Ecology"*, W.B. Sunders Co., USA,1975.
3. G.L. Karia and R.A. Christian, *Waste Water Treatment, Concepts and Design Approach,* Prentice Hall of India, 2005.
4. Benny Joseph, *Environmental Studies*, Tata McGraw Hill,2005.
5. V.K.Sharma, *Disaster Management, National Centre for Disaster Management*, IIPE, Delhi,1999.
6. *Environmental Science: towards a sustainable future* by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi

PC 451 EC

Analog Electronic Circuits Laboratory

Credits:1

Instruction : 2p hr per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *Design and analyze BJT, FET amplifiers.*
- *Design and analyze multivibrators*
- *Analyze Oscillator circuits*
- *Understand Op-Amp applications*
- *Understand filter circuits*

Course Outcomes

- *Calculate gain and bandwidth of BJT, FET.*
- *Study multivibrator circuits.*
- *Study oscillator circuits.*
- *Demonstrate filter circuits*
- *Demonstrate power amplifier and Op-Amp Circuits*

List of Experiments

1. Two Stage RC Coupled CE BJT amplifier.
2. Two Stage RC Coupled CS FET amplifier.
3. Voltage Series Feedback Amplifier.
4. Voltage Shunt Feedback Amplifier.
5. Current series feedback Amplifier
6. RC Phase Shift Oscillator.
7. Hartley & Colpitt's Oscillators
8. Design of Class A and Class B Power amplifiers.
9. Constant-k low pass & high pass filters.
10. m-Derived low pass & high pass filters.
11. Series and Shunt voltage Regulators
12. RF Tuned Amplifier

SPICE:

13. Two Stage RC Coupled CS FET amplifier.
14. Voltage Series Feedback Amplifier
15. Current Shunt Feedback Amplifier

Suggested Reading:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text – Lab Manual*, 7th Edition, TMH 2001.

Note: A minimum of 10 experiments should be performed. It is mandatory to simulate any three experiments using SPICE.

PC 452 EC

Pulse and Integrated Circuits Laboratory

Credits:1

Instruction: 2P per week *Duration of SEE: 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To implement high pass and low pass circuit and study it`s performance.*
- *To implement clipping and clamping circuits and study it`s performance.*
- *To design and test bi-stable, mono-stable multi-vibrators.*
- *To design and test filter circuits.*
- *To understand data conversion.*

Course Outcomes:

- *Design and analyze linear wave shaping circuits.*
- *Design and analyze clipping and clamping circuits.*
- *Design and analyze multivibrator circuits.*
- *Design Op-AMP applications.*
- *Effective use of 555 timer.*

List of Experiments

1. Verification of Low Pass circuit response to step, pulse and square inputs
2. Verification of High Pass RC Circuit response to step, pulse and square inputs
3. Design and verification of RC integrator and differentiator Circuits
4. Design and verification of Low pass and High pass Filters
5. Design and verification of Clipping Circuit (shunt and series)
6. Design and verification of Clamping Circuits (Positive and Negative, with and without bias)
7. Measurement of OPAMP Parameters
8. Inverting and Non-inverting OP-AMP Voltage follower
9. Integrator and Differentiator using OPAMP
10. Design and verification of Active filters
11. Astable and Mono stable multi vibrator using NE555 IC
12. Voltage regulators
13. Digital to Analog Converters
14. Analog to Digital Converters

Note: A minimum of 10 experiments should be performed.

Suggested Reading:

1. Robert Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 5th Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.
2. David A. Bell, Laboratory Manual for “Electronic Devices and Circuits”, 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2004.

Service Course

ES 401 EC

Digital Electronics (BME)

Credits:3

Instruction : 3p hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *This course facilitates the students to study the properties for Boolean algebra and simplification of Boolean equations using K-maps.*
- *The digital circuits' classification is studied and the main elements of this classification are studied. Application of these circuits to build a basic computer is discussed.*
- *The students also learn about different types of memories and how they are programmed.*
- *The course also discusses about the basic applications of digital electronics like digital clock, frequency counter.*

Course Outcomes:

- *Understand various codes and simplify Boolean equations using K-maps*
- *Design basic data processing circuits*
- *Applications of flip-flops*
- *To build a basic computer architecture and memories*
- *Build ADCs and DACs*

UNIT-I

Codes: BCD, ASCII code, Excess-3 code, Gray code. Error detecting and error correcting codes.
Combinational Logic Design: Boolean laws & theorems. Karnaugh Map-simplification of Boolean expressions- Sum of Products (SOP) form, Product of Sums (POS) form.
Logic Gates, Implementations of Logic Functions using gates, Realization of Boolean Expressions using universal gates.

UNIT-II

Arithmetic Circuits: Half adder, Full adder, Half subtractors, Full subtractors, Parallel binary adder, parallel binary Subtractor. Code-converters
Data processing circuits: Multiplexers, De-Multiplexers, Encoders-Priority Encoder, Decoders.
Digital Circuit Testing tools: Logic pulser, Logic probe, Current Tracer.

UNIT-III

Sequential circuits: Flip-flops-RS, D, JK and JK Master slave. Realizations of one flip flop using other flip flops.
Registers: Serial-in parallel-out, Serial-in Serial-out, parallel-in-serial-out parallel-in-parallel-out.
Counters: Asynchronous and synchronous counters, decade counters, ring counters. Design of synchronous counters using excitation tables, Synchronous Up/Down counters.

UNIT-IV

Classification of memories – ROM – ROM organization – PROM – EPROM – EEPROM – EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle – Timing wave forms , RAM Cell , Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using ROM, PLA, PAL.

Applications: Digital Clock, Frequency counter, Time measurement, Displays.

UNIT-V

Introduction to DAC, ADC: Sampling, Quantization, quantization noise, aliasing and reconstruction filtering, Specifications, DAC Conversion, Binary weighted Resistor DAC, R-2R Ladder DAC, Inverted (or) Current mode DAC, Sample and hold circuits,

ADC conversion, Types of ADCs: Direct Conversion ADC/Flash type ADC, Successive approximation ADC, Integrating ADCs, Sigma-Delta ADCs, Analog Multiplexers.

Suggested Reading:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Donald P.Leach & Albert Paul Malvino, *Digital Principles and electronic*, 5th Ed., Tata Mc. Graw Hill Publishing Co. Ltd., New Delhi, 2003
3. R. P. Jain, *Modern Digital Electronics*, 3rd Ed., Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2003

ES 451 EC

Digital Electronics Laboratory (BME)

Credits:2

Instruction : 3p hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *Analyze and design dc and switching circuits.*
- *Analyze and design combinational logic circuits.*
- *Analyze and design sequential circuits.*

Course Outcomes:

On the completion of this laboratory course, the students will be able to:

- *Demonstrate the truth table of various expressions and combinational circuits using logic gates.*
- *Design, test and evaluate various combinational circuits such as adders, subtractors, multiplexers and de-multiplexers.*
- *Construct flips-flops, counters and shift registers.*
- *Simulate BCD 7-Segment Display.*
- *Design and implement multivibrators using IC 555.*

I. List of Experiments:

1. Clippers and Clampers - Series and Parallel
2. Astable, Monostable and Bistable Multivibrators
3. Logic Gates-AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR
4. Half Adder, Full Adder, Half Subtractor, Full Subtractor
5. Flip Flops-SR, JK, D, T, JK-Master Slave
6. A/D and D/A converters
7. Multiplexers and Demultiplexers
8. Shift register-Series/Parallel-in to Series/Parallel-out
9. CMOS-TTL and TTL-CMOS interfacing
10. BCD-7 segment Display, DPM
11. PLL and Voltage Controlled Oscillator
12. Counters-Decade, Binary, Divide-by-N

II. Mini Project and Design exercises:

Mini project is to be executed batch-wise. Design exercises are to be carried out individually.

ES 452 EC

Applied Electronics Laboratory (ME)

Credits:1

Instruction : 2p hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

Course Objectives:

- *To understand the characteristics of diodes and transistor configurations*
- *To understand the design concepts of biasing of BJT and FET*
- *To understand the design concepts of feedback amplifiers and oscillators*
- *To study the design concepts of OP Amp and data converters*

Course Outcomes:

- *Ability to design diode circuits & understand the application of Zener diode.*
- *Ability to analyze characteristics of BJTs & FETs.*
- *Ability to understand the different oscillator circuits.*
- *Ability to understand operation of HWR & FWR circuits with & without filters.*
- *Ability tom design Analog-to-Digital converters & Digital-to-Analog converters.*

List of Experiments:

1. CRO-Applications, Measurements of R, L and C using LCR meter, Color code method and soldering practice.
2. Characteristics of Semiconductors diode (Ge,Si and Zener)
3. Static Characteristics of BJT-Common Emitter
4. Static Characteristics of BJT-Common Base
5. Static Characteristics of FET
6. RC-Phase Shift Oscillator
7. Hartley and Colpitts Oscillators
8. Common Emitter Amplifier
9. Astable Multivibrator
10. Full-wave rectifier with and without filters using BJT
11. Operational Amplifier Applications
12. Strain Guage Measurement
13. Analog-to-Digital and Digital to Analog Converters

Suggested Reading:

1. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics*, 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India, 2001.