VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE (HONOURS)

MAJOR IN ELECTRONICS

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE (HONOURS) MAJOR IN ELECTRONICS
(under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. (Hons.)	2nd	III	**SEMESTER-III**							
			Major-3	**ELCHMJ03**	**T: Mathematics Foundation for Electronics; P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			Major-4	**ELCHMJ04**	**T: Electromagnetics; P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			SEC	**ELCSEC03**	**P: Design and Fabrication of Printed Circuit Boards**	**3**	**0-0-3**	**10**	**40**	**50**
			AEC	**AEC03**	Communicative English -2 (***common for all programmes***)	**2**	**2-0-0**	**10**	**40**	**50**
			MDC	**MDC03**	Multidisciplinary Course -3 (***to be chosen from the list***)	**3**	**3-0-0**	**10**	**40**	**50**
			Minor-3 (Disc.-I)	**ELCMIN03**	**T: Digital Electronics & Logic Circuits; P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
					Semester-III Total	**20**				**375**
		IV	**SEMESTER-IV**							
			Major-5	**ELCHMJ05**	**T: Transmission Lines, Antenna and Wave Propagation; P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			Major-6	**ELCTHMJ06**	**T: C Programming and Data Structures; P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			Major-7	**ELCHMJ07**	**T: Applied Physics; P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			AEC	**AEC04**	MIL-2 (***common for all programmes***)	**2**	**2-0-0**	**10**	**40**	**50**
			Minor-4 (Disc.-II)	**ELCMNI04**	**T: Fundamentals of Semiconductor Devices & Applications; P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			Summer Intern.	**INT**	**Internship/ Apprenticeship - activities to be decided by the Colleges following the guidelines to be given later**	**4**	**0-0-4**	**-**	**-**	**50**
					Semester-IV Total	**22**				**400**
					TOTAL of YEAR-2	**42**				**775**

MJ = Major, MI = Minor Course, SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical, MIL = Modern Indian Language

MAJOR (MJ)

MJ-3: Mathematics Foundation for Electronics **Credits 04 (Full Marks: 75)**

MJ-3T: Mathematics Foundation for Electronics (Theory) **Credits 03 (Lectures 60)**

Course contents:

Unit-1 **(16 Lectures)**

Differential Equations: First-order and Second-order and Partial Differential Equations and its solutions techniques. (8 Lectures)

Series solution of differential equations and special functions: Power series method, Legendre Polynomials, Frobenius Method, Bessel's equations, and Bessel's functions of first and second kind. Error functions and gamma function. (8 Lectures)

Unit-2 **(5 Lectures)**

Vector Analysis: Scalars and Vectors, Vector Algebra, Rectangular, Cylindrical and Spherical Coordinate Systems, Vector Field, Products, Differential Length, Area and Volume, Line, Surface and Volume integrals, Gradient, Divergence, and Curl operations.

Unit-3 **(13 Lectures)**

Matrices: Introduction to Matrices, Real and Complex Matrices, Symmetric, Skew Symmetric, Orthogonal Quadratic Form, Hermitian, Skew Hermitian, Diagonalization, Unitary Matrices, Powers of a Matrix. System of Linear Algebraic Equations, Eigen Values and Eigen Vectors, Linear Transformation, Gaussian Elimination Method, Gauss-Seidel Method, Cayley-Hamilton Theorem,

Unit-4 **(10 Lectures)**

Sequences and series: Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for Convergence, Cauchy's Integral Test, D'Alembert's Ratio Test, Cauchy's nth Root Test, Alternating Series, Leibnitz's Theorem, Absolute Convergence and Conditional Convergence, Power Series.

Unit-4 **(16 Lectures)**

Complex Variables and Functions: Complex Variable, Complex Function, Continuity, Differentiability, Analyticity. Cauchy-Riemann (C-R) Equations, Harmonic and Conjugate Harmonic Functions, Exponential Function, Trigonometric Functions, Hyperbolic Functions. Line Integral in Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivative of Analytic Functions. Sequences, Series and Power Series, Taylor's Series, Laurent Series, Zeros and Poles. Residue integration method, Residue integration of real Integrals.

Suggested Books:

1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)
2. Murray Spiegel, Seymour Lipschutz, John Schiller, Outline of Complex Variables, Schaum Outline Series, Tata McGraw Hill (2007)
3. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007)
4. C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)
5. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited (2007).

MJ-3P: Mathematics Foundation for Electronics Lab (Scilab/MATLAB/ any other Mathematical Simulation software) **Credits 01**

Course contents:

1. Solution of First Order Differential Equations.
2. Solution of Second Order homogeneous Differential Equations.
3. Solution of Second Order non-homogeneous Differential Equations.
4. Convergence of a given series.
5. Divergence of a given series.
6. Solution of linear system of equations using Gauss Elimination method.
7. Solution of linear system of equations using Gauss – Seidel method.
8. Solution of linear system of equations using L-U decomposition method.

MJ-4: Electromagnetics **Credits 04 (Full Marks: 75)**

MJ-4T: Electromagnetics (Theory) **Credits 03**

Course contents:

Unit-1 (12 Lectures)

Electrostatic Fields: Coulomb's Law and Electric Field, Discrete and Continuous Charge Distributions, Electric Flux Density, Gauss's Law and Applications, Divergence Theorem. Electric Potential, Electrostatic Energy and Forces, Electric dipole. Dielectric materials, Capacitance and Capacitors, Polarization, Isotropic and Anisotropic dielectrics, Method of Images, Boundary Conditions. Electric Fields in Conductors, Current and Current Density, Metallic Conductors.

Unit- 2 (14 Lectures)

Poisson's Equation and Laplace's Equation: Derivation of Poisson's and Laplace's equation, Uniqueness Theorem, Solution of Laplace's Equation: Cartesian, Cylindrical and Spherical Coordinates.

Magnetostatics: Biot-Savert's law and Applications, Magnetic dipole, Magnetic Flux and Magnetic Flux Density, Ampere's Circuital Law, Curl and Stokes' Theorem, Maxwell's Equations, Scalar and Vector Magnetic Potentials. Magnetization, Permeability, Anisotropic materials, Magnetic Forces, Torques and Energy, Magnetic Circuits.

Unit-3 (13 Lectures)

Time-Varying Fields and Maxwell's Equations: Faraday's Law of Electromagnetic Induction, Stationary Circuit in Time-Varying Magnetic Field, Displacement Current, Maxwell's Equations in differential and integral form and Constitutive Relations. Potential Functions, Lorentz gauge, Concept of Retarded Potentials. Electromagnetic Boundary Conditions, Time-Harmonic Electromagnetic Fields and use of Phasors.

Unit-4 (17 Lectures)

Electromagnetic Wave Propagation: Electromagnetic Spectrum, Wave Equation in a source free isotropic homogeneous media, Uniform Plane Waves in Lossless and Lossy unbounded homogeneous media, Wave Polarization, Phase and Group velocity, Flow of Electromagnetic Power and Poynting Vector. Concept of reflection and standing wave.

Guided Electromagnetic Wave Propagation: TEM, TE and TM waves, Electromagnetic Wave Propagation in Parallel Plate and Rectangular Metallic Waveguides.

Suggested Books:

1. Murray. R. Spiegel, Vector Analysis, Schaum series, Tata McGraw Hill (2006)
2. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press (2001)
3. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
4. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
5. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006)
6. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006)
7. Introduction to Electrodynamics, D.J. Griffiths, Pearson Education (2012)
8. Electromagnetic Wave and Radiating System, Jordan and Balmain, Prentice Hall (1979)

MJ-4P: Electromagnetics Lab (using Scilab/ any other similar freeware) Credits 01

1. Understanding and Plotting Vectors.
2. Transformation of vectors into various coordinate systems.
3. 2D and 3D Graphical plotting with change of view and rotation.
4. Representation of the Gradient of a scalar field, Divergence and Curl of Vector Fields.
5. Plots of Electric field and Electric Potential due to charge distributions.
6. Plots of Magnetic Flux Density due to current carrying wire.
7. Programs and Contour Plots to illustrate Method of Images
8. Solutions of Poisson and Laplace Equations – contour plots of charge and potential distributions
9. Introduction to Computational Electromagnetics: Simple Boundary Value Problems by Finite Difference/Finite Element Methods.

MJ-5: Transmission Lines, Antenna and Wave Propagation Credits 04 (Full Marks: 75)

MJ-5T: Transmission Lines, Antenna and Wave Propagation (Theory) Credits 03

Course contents:

Unit-1 (15 Lectures)

Electromagnetic Wave Propagation: Propagation in Good Conductors, Skin Effect, Reflection of uniform Plane Waves at normal incidence, Plane Wave reflection at Oblique Incidence, Wave propagation in dispersive media, concept of phase velocity and group velocity.

Unit-2 (17 Lectures)

Transmission Lines: Typical Transmission lines- Co-axial, Two Wire, Microstrip, Coplanar and Slot Lines, Transmission Line Parameters, Transmission Line Equations, Wave propagation in Transmission lines, low loss, lossless line, Distortion less line, Input Impedance, Standing Wave Ratio, Power. and lossy lines, Shorted Line, Open-Circuited Line, Matched Line, Smith Chart, Transmission Line Applications.

Unit-3 (13 Lectures)

Waveguides and Waveguide Devices: Wave propagation in waveguides, Parallel plate waveguides, TM, TE and TEM modes, Rectangular waveguides, circular waveguides, Power transmission and attenuation, Rectangular cavity resonators, directional couplers, isolator, circulator.

Unit-4 (15 Lectures)

Radiation of electromagnetic waves: Concept of retarded potentials, Antenna Parameters, Radiation Mechanism, Current Distribution on a Thin Wire Antenna, Radiation Pattern, Radiation Power Density, Radiation Intensity, Beam width, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Effective Length and Equivalent Areas, Maximum Directivity and Maximum Effective Area, Friis Transmission Equation and Radar Range Equation

Types of Antenna: Hertzian dipole, Half wave dipole, Quarter-wave dipole, Yagi-Uda, microstrip, Parabolic antenna, Helical antenna, Antenna array.

MJ-5P: Transmission Lines, Antenna and Wave Propagation Lab (Scilab/MATLAB/Other Mathematical Simulation Software) **Credits 01**

1. Write a program to determine the phasor of forward propagating field
2. Write a program to determine the instantaneous field of a plane wave
3. Write a program to find the Phase constant, Phase velocity, Electric Field Intensity and Intrinsic ratio
4. Write a program to find skin depth, loss tangent and phase velocity
5. Write a program to determine the total voltage as a function of time and position in a lossless transmission line
6. Write a program to find the characteristic impedance, the phase constant an the phase velocity
7. Write a program to find the output power and attenuation coefficient
8. Write a program to find the power dissipated in the lossless transmission line
9. Write a program to find the total loss in lossy lines
10. Write a program to find the load impedance of a slotted line
11. Write a program to find the input impedance for a line terminated with pure capacitive impedance
12. Write a program to determine the operating range of frequency for TE10 mode of air filled rectangular waveguide
13. Write a program to determine Directivity, Bandwidth, Beam width of an antenna
14. Write a program to determine diameter of parabolic reflector
15. Write a program to find out minimum distance between primary and secondary antenna

OR

Tutorial/ Submission of Dissertation/ Term project/ student Seminar on **Transmission Lines, Antenna and Wave Propagation**

Suggested Books:

1. M. N. O. Sadiku, Principles of Electromagnetics, Oxford University Press (2001)
2. Karl E. Longren, Sava V. Savov, Randy J. Jost., Fundamentals of Electromagnetics with MATLAB, PHI

3. W. H. Hayt and J.A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
4. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
5. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006)
6. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006)
7. G. S. N. Raju, Antennas and Propagation, Pearson Education (2001)

MJ-6: C Programming and Data Structures Credits 04 (Full Marks: 75)

MJ-6T: C Programming and Data Structures (Theory) Credits 03

Course contents:

Unit- 1 (10 Lectures)

C Programming Language: Introduction to C, Character set, Tokens, keywords, identifier, constants, basic data types, variables: declaration & assigning values. Structure of C program. Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, expressions and evaluation of expressions.

Unit-2 (21 Lectures)

Decision making, branching & looping: Decision making, branching and looping: if, if-else, else-if, switch statement, break, for loop, while loop and do loop. Functions: Defining functions, function arguments and passing, returning values from functions. Arrays-concepts, two-dimensional and multi-dimensional arrays. Input output statement and library functions (math and string related functions).

Structures: defining and declaring a structure variables, accessing structure members, initializing a structure, copying and comparing structure variables, array of structures, arrays within structures, structures within structures, structures and functions. Pointers.

Introduction to C++: Object oriented programming, characteristics of an object-oriented language.

Unit-3 (15 Lectures)

Data Structures: Definition of stack, array implementation of stack, conversion of infix expression to prefix, postfix expressions, evaluation of postfix expression. Definition of Queue, Circular queues, Array implementation of queues. Linked List and its implementation, Link list implementation of stack and queue, Circular and doubly linked list.

Unit-4 (14 Lectures)

Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort, linear Search, binary search.

Trees : Introduction to trees, Binary search tree, Insertion and searching in a BST, preorder, postorder and inorder traversal (recursive)

Suggested Books:

1. Yashavant Kanetkar, Let Us C , BPB Publications
2. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
3. Byron S Gottfried, Programming with C , Schaum Series
4. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall
5. YashavantKanetkar, Pointers in C, BPB Publications
6. S. Sahni and E. Horowitz, “Data Structures”, Galgotia Publications

7. Tanenbaum: “Data Structures using C”, Pearson/PHI.
8. Ellis Horowitz and Sartaz Sahani “Fundamentals of Computer Algorithms”, Computer Science Press.

MJ-6P: C Programming and Data Structures Lab (Practical) Credits 01

1. Generate the Fibonacci series up to the given limit N and also print the number of elements in the series.
2. Find minimum and maximum of N numbers.
3. Find the GCD of two integer numbers.
4. Calculate factorial of a given number.
5. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non – zero coefficients A, B and C. Else report error.
6. Calculate the value of sin (x) and cos (x) using the series. Also print sin (x) and cos (x) value using library function.
7. Generate and print prime numbers up to an integer N.
8. Sort given N numbers in ascending order.
9. Find the sum & difference of two matrices of order MxN and PxQ.
10. Find the product of two matrices of order MxN and PxQ.
11. Find the transpose of given MxN matrix.
12. Find the sum of principle and secondary diagonal elements of the given MxN matrix.
13. Calculate the subject wise and student wise totals and store them as a part of the structure.
14. Maintain an account of a customer using classes.
15. Implement linear and circular linked lists using single and double pointers.
16. Create a stack and perform Pop, Push, Traverse operations on the stack using Linear Linked list
17. Create circular linked list having information about a college and perform Insertion at front, Deletion at end.
18. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete, and Display the queue elements.
19. Implement polynomial addition and subtraction using linked lists.
20. Implement sparse matrices using arrays and linked lists.
21. Create a Binary Tree to perform Tree traversals (Preorder, Postorder, Inorder) using the concept of recursion.
22. Implement binary search tree using linked lists. Compare its time complexity over that of linear search.
23. Implement Insertion sort, Merge sort, Bubble sort, Selection sort.

MJ-7: Applied Physics **Credits 04 (Full Marks: 75)**

MJ-7T: Applied Physics (Theory) **Credits 03**

Course contents:

Unit-1 **(20 Lectures)**

Quantum Physics: Inadequacies of Classical physics. Compton's effect, Photo-electric Effect, Wave-particle duality, de Broglie waves. Basic postulates and formalism of quantum mechanics: probabilistic interpretation of waves, conditions for physical acceptability of wave functions. Schrodinger wave equation for a free particle and in a force field (1 dimension), Boundary and continuity conditions. Operators in Quantum Mechanics, Conservation of probability, Time-dependent form, Linearity and superposition, Operators, Time- independent one dimensional Schrodinger wave equation, Stationary states, Eigen-values and Eigen functions. Particle in a one-dimensional box, Extension to a three dimensional box, Potential barrier problems, phenomenon of tunneling. Kronig Penney Model and development of band structure. Spherically symmetric potentials, the Hydrogen-like atom problem.

Unit-2 **(25 Lectures)**

Electronic Materials

Introduction: Atomic structure and bonding, types of bindings, Classification of materials on bonding: conductors, semiconductors and insulators, imperfections in solids

Dielectric properties of materials: Macroscopic electric field, dielectric constant and polarization, types of polarization, local field at an atom, temperature dependence on polarization, dielectric loss, ferroelectricity, anti-ferroelectricity, piezoelectricity.

Optical properties of materials**:** Index of refraction, damping constant, penetration depth, absorbance, reflectivity, transmissivity, electronic inter-band and intra-band transitions, optical properties and band structure, photoluminescence and electroluminescence.

Nanomaterials**:** Introductory concept of nanomaterials, low dimension structures: quantum well, wire and dots Graphene, carbon nano tube (CNT), metamaterial.

Unit-3 **(15 Lectures)**

Electric and Magnetic Properties: Conductivity of metals, Ohm's Law, relaxation time, collision time and mean free path, electron scattering and resistivity of metals, heat developed in current carrying conductor, Superconductivity.

Classification of Magnetic Materials, Origin of Magnetic moment, Origin of dia, para, ferro and antiferro magnetism and their comparison, Ferrimagnetic materials, Saturation Magnetisation and Curie temperature, Magnetic domains, Concepts of Giant Magnetic Resistance (GMR), Magnetic recording.

Suggested Books:

1. S. Vijaya and G. Rangarajan, Material Science, Tata Mcgraw Hill (2003)
2. W. E. Callister, Material Science and Engineering: An Introduction, Wiley India (2006)
3. Beiser, Concepts of Modern Physics , McGraw-Hill Book Company (1987)
4. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, Macmillan India (2004)

MJ-7P: Applied Physics Lab (Practical) **Credits 01**

1. Measurement of resistivity of a Silicon/Germanium wafer using four probe methods and to determine its band gap.
2. Determination of carrier concentration, mobility of a semiconductor sample using Hall measurements.
3. Determination of the Curie temperature of Barium Titanate.
4. To measure the resistivity of a Ge crystal with temperature by four –probe method from room temperature to 200 ^{0}C).
5. To determine the value of Boltzmann Constant by studying forward characteristics of diode.
6. To determine the value of Planck's constant by using LEDs of at least 4 different wavelengths.
7. To determine e/m of electron by Bar Magnet or by Magnetic Focusing.

MINOR (MI)

MI – 3: Digital Electronics & Logic Circuits **Credits 04 (Full Marks: 75)**

MI – 3T: Digital Electronics & Logic Circuits (Theory) **Credits 03**

Course contents:

Number Systems and Boolean algebra-

Number System and Codes: Decimal, Binary, Hexadecimal, Octal, BCD, Conversions, Complements (1's and 2's), Signed and unsigned numbers, addition, subtraction and multiplication, Gray Codes.

Boolean algebra and Logic gates: Boolean algebra- Positive and negative logic. Boolean laws. De Morgan's theorems, simplification of Boolean expressions-SOP and POS. Logic gates- AND, OR, NOT, NAND, NOR, XOR & XNOR, logic symbol and truth table, Universal gates. Fan In and Fan out, power dissipation and noise Immunity, propagation delay, K-map.

Combinational Logic: Combinational logic analysis and design: Adder, Subtractor (half and full), Encoder and Decoder, Multiplexers and Demultiplexers.

Sequential Logic
Sequential logic design: Latch, Flip flop (FF), S-R FF , J-K FF, T and D type FFs, clocked FFs, registers, Counters (ripple, synchronous and asynchronous, ring, modulus).

MI – 3P: Digital Electronics & Logic Circuits (Practical) **Credits 01**

Course Outline:

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. To convert a Boolean expression into logic gate circuit and assemble it using logic gate IC's.
3. Design a Half and Full Adder Half and Full Subtractor,.
4. Design of a decoder / Multiplexer circuit using gates.
5. Design a seven segment display driver.
6. Boolean Function implementation using Decoder and Multiplexer.
7. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
8. Design a counter using D/T/JK Flip-Flop.
9. Design a shift register and study Serial and parallel shifting of data.

Reference Books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India (2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (1994)

MI-4: Fundamentals of Semiconductor Devices & Applications Credits 04 (Full Marks: 75)

MI-4T: Fundamentals of Semiconductor Devices & Applications (Theory) Credits 03

Course contents:

Basic Circuit Concepts: Resistors, Inductors and Capacitors: classifications and basic concepts. Voltage and Current Sources.

Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Star-Delta Conversion.

Network Theorems: Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

P-N Junction Diode: Formation of Depletion Layer, Diode Equation and I-V Characteristics. Zener and Avalanche Junction Breakdown Mechanism.

Diode Circuits: Rectifiers–DC power supply, Filters, Clipping and clamping circuits. Regulation using Zener, Concepts of Metal Semiconductor Junctions.

Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Current Gain, Energy Band Diagram of Transistor in Thermal Equilibrium, Quantitative Analysis of Static Characteristics (Minority Carrier Distribution and Terminal Currents), Base-Width Modulation, Input and Output Characteristics of CB, CE and CC Configurations.

Circuits using Bipolar Junction Transistor: Hybrid parameters, Different Transistor biasing, DC load line, operating point, thermal runaway, stability and stability factor. Transistor as a switch; Transistor as amplifier, Types of Amplifier: Voltage and Power amplifier, Classes of amplifiers.

Feedback Amplifiers:

Concept of feedback, negative and positive feedback, Feedback topologies, Barkhausen criteria for oscillations, Oscillators.

Regulated power supply: series and shunt (using BJT) Circuit diagram, Working and Frequency Response for each, Limitations of single tuned amplifier, Applications of tuned amplifiers in communication circuits.

JFET–Types - p-channel and n-channel, working and I-V characteristics of JFET, parameters and their relationships, Comparison of BJT and JFET.

MOSFET Circuits:

Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits.

Op-Amp: Block diagram of Op-Amp, Characteristics of an Ideal and

Practical Op-Amp, offset voltage, offset current, input bias current, concept of Virtual Ground, differential input

resistance, CMRR, Slew Rate, Differential Amplifier, Open and closed loop configuration, supply voltage rejection ratio.

Applications of op-amps: Inverting and non- inverting amplifiers, Adder, Subtractor, Differentiator, Integrator, Comparator, Differential amplifier and Zero-crossing detector.

MI-4P: Fundamentals of Semiconductor Devices & Applications (Practical) Credits 01

Course Outline:

01. Study of the forward and reverse I-V Characteristics of a Diode.
02. Study of the input and output Characteristics of the of BJT .
03. Study of the I-V Characteristics of JFET.
04. Study of the half wave rectifier and Full wave rectifier.
05. Study of voltage regulator using Zener diode.
06. Designing of a Single Stage CE amplifier.
07. Designing of an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
08. Study of the zero-crossing detector and comparator using OP-AMP.
09. Designing of analog adder and subtractor circuit.
10. Designing of an integrator using op-amp for a given specification and study its frequency response.
11. Designing of a differentiator using op-amp for a given specification and study its frequency response.
12. Study of a differential amplifier circuit using OP-AMP.

Reference Books

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky,9thEdition, 2013, PHI
2. Electronic Devices, David A Bell, Reston Publishing Company
3. D.L.Schilling and C.Belove, Electronic Circuits :Discrete and Integrated, Tata McGraw Hill (2002)
4. DonaldA.Neamen, Electronic Circuit Analysis and Design, Tata McGrawHill (2002)
5. J.Millman and C.C.Halkias, Integrated Electronics, TataMcGraw Hill(2001)
6. J.J.Cathey,2000
7. Solved Problems in Electronics, Schaum' soutline Series, TataMcGraw Hill (1991)
8. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation
9. Sedra Smith, Microelectronic Circuits, 6/E Oxford
10. Bogart Electronic Devices and Circuits,6ePearson

SKILL ENHANCEMENT COURSE (SEC)

SEC 3: Design and Fabrication of Printed Circuit Boards **Credits 03**

SEC3P: Design and Fabrication of Printed Circuit Boards **Full Marks: 50**

Course Outline:

PCB Fundamentals: PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD).
Classification of PCB - single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards.
Schematic & Layout Design: Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Netlist, creating components for library, Tracks, Pads, Vias, power plane, grounding.
Technology OF PCB: Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Foot prints and Libraries Adding and Editing Pins, copper clad laminates materials, properties of laminates (electrical & physical), types of laminates, soldering techniques. Film master preparation, Image transfer, photo printing, Screen Printing, Plating techniques etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing and quality controls.
PCB Technology: Trends, Environmental concerns in PCB industry.

Suggested Readings:

1. Printed circuit Board–Design &Technology by Walter C .Bosshart, TataMcGrawHill.
2. Printed Circuit Board–Design, Fabrication, Assembly &Testing, R.S.Khandpur, TATA McGraw Hill Publisher