SCHEME OF INSTRUCTION AND SYLLABI R-22(A)

OF

B.E. I to VIII SEMESTERS OF FOUR YEAR DEGREE COURSE

IN

ELECTRONICS ENGINEERING
(VLSI DESIGN AND TECHNOLOGY)

(Revised AICTE Model Curriculum with effect from AY 2024-25)

R–22 (A) Regulation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Affiliated to OU, Approved by AICTE, Accredited by NBA, NAAC (A++)

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

Institute Vision	To be a Centre of excellence in technical education and research.
Institute Mission	To address the emerging needs through quality technical education and advanced research.

(A)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

Program Outcomes of BE (Electronics Engineering – VLSI Design and Technology)

1. Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
2. Problem Analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

AICTE Model Curriculum with effect from AY 2024-25

BE (Electronics Engineering – VLSI Design and Technology)

SEMESTER – I

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC02	Calculus	3	1	-	3	40	60	4
2	22CYC01	Chemistry	3	-	-	3	40	60	3
3	22EEC01	Basic Electrical Engineering	2	1	-	3	40	60	3
4	22CSC40	Problem Solving and Programming using Python	2	1	-	3	40	60	3
PRACTICALS									
5	22CYC02	Chemistry Lab	-	-	3	3	50	50	1.5
6	22MBC02N	Community Engagement	-	-	2	-	50	-	1
7	22CSC41	Problem Solving and Programming using Python Lab	-	-	3	3	50	50	1.5
8	22MEC37N	Robotics and Drones Lab	-	1	3	-	100	-	2.5
9	22EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
Total			**10**	**4**	**13**	**21**	**460**	**390**	**20.5**
Clock Hours Per Week: 27									

L: Lecture D: Drawing **CIE: Continuous Internal Evaluation**

T: Tutorial P: Practical/Project Seminar/Dissertation SEE: Semester End Examination

22MTC02

CALCULUS
(Common to ECE, EEE, MECH, CHEM, CIVIL, EE)

Instruction	3 L + 1T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

This course aims to:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss mean value theorems.
3. To explain the Partial Derivatives and the extreme values of functions of two variables.
4. To explain the shape of curves, their areas and volumes of revolutions.
5. To discuss the convergence and divergence of the series.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve system of linear equations.
2. Analyze the geometrical interpretation of Mean value theorems and curvature.
3. Determine the extreme values of functions of two variables.
4. Find the shape of the curve, surface areas and volumes of revolution.
5. Examine the convergence and divergence of infinite Series.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	-	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	2
CO 5	3	3	3	1	-	-	-	-	-	-	-	1

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear system of equations, Linear dependence and independence of vectors. Eigen values, Eigenvectors, Properties of Eigen values and Eigen vectors, Cayley Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Calculus: Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's Mean value theorem (without proofs). Curvature, Radius of curvature, Centre of curvature, Evolute and Involute, Envelopes.

UNIT-III

Partial Differentiation and Its Applications: Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Applications of definite integrals: Curve tracing of standard curves (Cartesian only), Applications of definite integrals to evaluate length of curves, surface areas and volumes of revolutions.

UNIT-V

Sequences and Series: Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Alternating series, Leibnitz's series, absolute and conditional convergence**.**

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. B.V.Ramana., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. David.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

e-Resources:

1. https://archive.nptel.ac.in/courses/111/107/111107112/(Unit-1,3 and 5)
2. NPTEL :: Mathematics - NOC:Differential Calculus in Several Variables- https:// archive. nptel.ac.in /courses/ 111/104/111104085/(Modules- 1,2,4, and 5)
3. NPTEL :: Mathematics - NOC:Advanced Calculus For Engineers (Week- 1,2,3 and 4)

22CYC01

CHEMISTRY

(Common to All Branches)

Instruction	3L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to:

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers.
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes: At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	-	-	2	2	-	-	-	-	2
CO 2	3	2	3	-	-	2	2	-	-	-	-	2
CO 3	3	2	2	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	3	2	3	-	-	2	2	-	-	-	-	2

UNIT-I

Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^-, CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II

Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials – Reference electrodes (NHE, SCE) - electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III

Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism -Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides).

Cyclization (Diels - Alder reaction)

UNIT–IV

Water Chemistry

Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process), ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V

Engineering Materials and Drugs:

Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.

Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).

Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd.,New Delhi,16th edition (2015).

2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

22EEC01

BASIC ELECTRICAL ENGINEERING

Instruction	2L + 1T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to:

1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To comprehend the basic principle of operation of AC and DC machines
3. To infer about different types of electrical wires and cables, domestic and industrial wiring. safety rules and methods of earthing.

Course Outcomes: After the completion of this course, the student will be able to:

1. Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
2. Predict the steady state response of RLC circuits with AC single phase/three phase supply.
3. Infer the basics of single phase transformer
4. Describe the construction, working principle of DC machine and 3-phase Induction motor.
5. Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	-	-	-	-	-	1	2	-	3
CO 2	3	3	2	-	-	-	-	-	1	2	-	3
CO 3	3	3	2	1	-	-	-	-	1	2	-	3
CO 4	2	1	-	-	-	-	-	-	1	2	-	3
CO 5	2	-	2	-	-	-	-	-	1	2	-	3

UNIT-I

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin's and Norton's Theorems.

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, series RL and RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Single Phase Transformer: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt generators. DC Motors: Classification, Torque Equation, Characteristics and Speed control of DC Shunt and Series Motors, Losses and efficiency Three - Phase Induction Motors: Principle of operation, Applications

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption.

Text Books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989
3. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013.

22CSC40

PROBLEM SOLVING AND PROGRAMMING USING PYTHON

Instruction	2L +1T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Basic Computer Skills.

Course Objectives:

This course aims to:

1. Master the fundamentals of writing Python scripts, learn core Python scripting elements such as variables, data types, operators and flow control structures.
2. Discover how to work with lists and sequence data and write Python functions to facilitate code reuse.
3. Explore Python Arrays, Perform Searching/Sorting using Collections, Use Python to read and write files.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand real world problems and Create algorithms/flowcharts/decision tables for solving those problems.
2. Interpret the data types, operators and tokens of Python for solving basic programming solutions.
3. Apply the constructs like selection, repetition and functions to modularize the programs.
4. Analyze searching/sorting techniques to solve problems that involve finding and manipulating data.
5. Design and build applications with built-in modules and files.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	1	1	1	2	-	-	-	-	1
CO 2	3	3	3	1	1	1	2	-	-	-	-	2
CO 3	3	3	3	1	1	1	2	-	-	-	-	2
CO 4	3	3	2	1	1	-	2	-	-	-	-	2
CO 5	3	3	3	1	2	1	2	-	-	-	-	2

UNIT - I

Techniques of Problem Solving: Algorithms, Flowcharts, Decision Table, Programming methodologies viz. top-down and bottom-up programming.

Software requirements for programming: Operating System, Editor (IDE), Compiler, Linker, Loader.

Introduction to Python: Structure of a Python Program, Python program execution steps, Python Interpreter and Script mode of programming, Lines and Indentation, Identifiers and keywords, Literals, Python suite, comments, quotation in python.

UNIT – II

Data Types in Python: Numeric (integer, float, complex), Sequence type with Functions and Methods (string, list and nested/multidimensional lists, tuple), Boolean, Set with Functions and Methods, Dictionary with Functions and Methods, Binary types (bytearray, bytes, memoryview). Type Conversion, Input-Output functions.

UNIT – III

Python Operators: Arithmetic, Relational, Logical, Bitwise, Assignment, Identity and Membership, Ternary operator. Operator precedence and associativity.

Decision Control Statements: Selection/Conditional Branching, Loop Control Structures, Nested Loops.

Comprehensions: List, Dictionary, Set comprehensions.

UNIT – IV

Arrays: Array Definition, Initialization and Accessing elements:1D arrays using array module, 2D arrays using numpy module.

Functions and Modules: Uses of functions, Function definition, Function call, Parameter types, Variable scope and Lifetime, Recursion, Lambda functions.

UNIT – V

Searching and Sorting Techniques: Linear Search, Binary Search, Selection Sort, Bubble Sort.

File Handling: File types, opening and closing files, reading and writing files, file positions.

Text Books:

1. Taming Python by Programming, Jeeva Jose, Revised Edition 2019, Khanna Book Publications.
2. Python Programming, Reema Thareja, Oxford Press, 2017.
3. Let us Python, Yashavant Kanetkar and Aditya Kanetkar, First Edition, 2019, BPB Publications.

Suggested Reading:

1. Learn Python 3 the Hard Way, Zed A. Shaw, First Edition, 2018, Pearson Education Inc.
2. Python in easy steps: Makes Programming Fun, Mike Mc Grath, Kindle Edition, 2017.
3. The Python Standard Library by Example by Doug Hellmann, Second Edition, June 2017.

e-Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_cs01/preview.
2. https://www.coursera.org/specializations/python.
3. https://www.python.org.
4. https://www.visual-paradigm.com/tutorials/decision-table-in-action.jsp.
5. https://www.coursera.org/specializations/python
6. https://www.python.org

22CYC02

CHEMISTRY LAB

(Common to All Branches)

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits:	1.5

Course Objectives:

This course aims to:

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis.
3. The student should be conversant with the principles of volumetric analysis.
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes:

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants / products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	3	2	3	-	-	2	2	-	-	-	-	2

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.

12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg&A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr.Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

22MBC02N

COMMUNITY ENGAGEMENT

Instruction	2P Hours per week
SEE	-
CIE	50 Marks
Credits	1

Course Objectives: This course aims to:

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:

1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	2	2	-	3	3	1	2	-	-	2
CO 2	-	1	2	2	-	3	2	-	2	1	-	1
CO 3	-	1	1	2	-	2	2	1	3	1	2	1
CO 4	2	2	3	2	-	2	2	1	2	2	1	-
CO 5	1	2	2	1	-	1	1	-	1	-	1	1

Module I Appreciation of Rural Society

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources. Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture, Farming, Landownership, Water management, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees.

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India. NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.

2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org / sdgs.
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

22CSC41

PROBLEM SOLVING AND PROGRAMMING USING PYTHON LAB

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Basic Computer Skills.

Course Objectives:

This course aims to:

1. Master the fundamentals of writing Python scripts.
2. Learn Python elements such as variables, flow controls structures, functions and modules.
3. Discover how to work with lists and sequence data, and files.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to design and build the solutions.
3. Develop the solutions with modular approach using functions to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of Standard Template Libraries and modules to build file handling/Searching/Sorting applications.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	-	1	1	-	-	-	-	-	-	2
CO 2	3	3	3	1	1	1	-	-	-	-	-	2
CO 3	3	3	3	1	2	1	-	-	-	-	-	2
CO 4	3	3	3	1	1	1	-	-	-	-	-	2
CO 5	3	3	3	1	2	1	-	-	-	-	-	2

Laboratory / Practical Experiments:

1. Explore various Python Program Development Environments.
2. Design Flowcharts using raptor / draw.io tools.
3. Simple scripts to demonstrate the use of basic data types and operators.
4. Demonstrate the use of control structures.
5. Experiments using Comprehensions with List, Dictionary, Set.
6. Implementation using Functions, Lambda functions and parameter passing.
7. Experiments using Searching and Sorting techniques.
8. Experimentation with Arrays using array and numpy modules.
9. Simple scripts to demonstrate the use of built-in modules.(Ex: math, random).
10. Demonstration of File Handling.

Text Books:

1. Taming Python by Programming, Jeeva Jose, Revised Edition 2019, Khanna Book Publications.
2. Python Programming, Reema Thareja, Oxford Press, 2017.
3. Let us Python, Yashavant Kanetkar and Aditya Kanetkar, First Edition, 2019, BPB Publications.

Suggested Reading:

1. Learn Python 3 the Hard Way, Zed A. Shaw, First Edition, 2018, Pearson Education Inc.
2. Python in easy steps: Makes Programming Fun, Mike Mc Grath, Kindle Edition, 2017.
3. The Python Standard Library by Example by Doug Hellmann, Second Edition, June 2017.

e-Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_cs01/preview.
2. https://www.coursera.org/specializations/python
3. https://www.python.org

22MEC37N

ROBOTICS AND DRONES LAB

Instruction	1 T + 3P Hours per week
Duration of SEE	-
SEE	-
CIE	100 Marks
Credits	2.5

Prerequisite: Nil

Course Objectives: This course aims to:

1. To develop a thorough understanding of various autonomous robot structures.
2. To gain expertise in working with various sensors and gain the ability to interface sensors with microcontrollers, read data, and seamlessly integrate them into robotics applications.
3. To acquire proficiency in understanding different types of motors, motor drivers, develop the skills to interface motors with microcontrollers, motors and construct two-wheel robots with controlled movements.
4. To attain proficiency in utilizing OpenCV for advanced image processing tasks master techniques such as RGB value extraction, creating colored shapes, and extracting Regions of Interest (ROI) from images.
5. To develop a thorough understanding of various drone structures / develop autonomous systems.

Course Outcomes: After completion of course, students would be able to:

1. Understand mechanical structures, motors, sensors, and circuits essential for constructing robots.
2. Demonstrate the utilization of sensors (Ultrasonic, IR, Rotary Encoder) for Arduino interfacing, reading data, and integrating them seamlessly into robotics applications.
3. Demonstrate expertise in operating robot controllers, applying theory to precisely control servo and stepper motors, 2 wheel robots ensuring desired motion.
4. Able to apply Python and OpenCV for image processing, including RGB extraction and ROI tasks.
5. Proficiently assemble a quadcopter drone, showcasing understanding of its classification, parts, and operational principles / Proficiency to develop autonomous systems fostering creativity and practical application.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	2	1	1	-	-	1	3	3	1	2
CO 2	1	2	2	1	1	-	-	1	3	3	1	2
CO 3	1	2	2	1	1	-	-	1	3	3	1	2
CO 4	2	2	2	1	1	-	-	1	3	3	1	2
CO 5	2	2	2	1	1	-	-	1	3	3	1	2

Lab Experiments:

Experiment No **Title**

1. Introduction to Robotics, Definition and scope of robotics, Robot configurations-Cartesian, cylinder, polar and articulate. Uses and Significance of Robots, Parts of a Robot, Current applications and future trends.
   Introduction to Arduino, C++, Arduino Programming Environment.
   Interfacing Arduino with Electronic Devices such as LEDs/Piezo Buzzer

2. Interfacing Arduino with Electronic Devices such as Push

Button/Potentiometer

3. Introduction to Sensors, Types of Sensors, Reading Data from Sensors, Interfacing Sensors with Microcontrollers.
   Interfacing Arduino with Ultrasonic Distance Sensor and Reading Sensor Data on Serial Monitor

4. Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor

5. Interfacing Arduino with Rotary Encoder and Reading Sensor Data on Serial Monitor

6. Introduction to motors, Types of motors, Motor drivers, Interfacing motors with Microcontrollers, Introduction to Li-ion, LIPO batteries, uses and safety precaution.
   Implement a system that utilizes an Arduino microcontroller to control the precise movement of a servo motor.

7. Implement a system that utilizes an Arduino microcontroller to control the precise and sequential movements of a stepper motor.

8. Construct a two-wheel robot using DC motors controlled by an Arduino microcontroller. Implement a program that allows the robot to execute specific movements.
   The robot should:
   i. Move forward with controlled acceleration.
   ii. Move backward with controlled deceleration.

9. Construct an Obstacle avoidance robot

10. Construct a Pick and place robot

11. OpenCv for image processing:
   i. Extraction of RGB values of a pixel
   ii. Create colored shapes and save image
   iii. Extraction of ROI

12. Assembly of quad copter drone.

Open-Ended Project on Autonomous System

Note:
- Mandatory Open-Ended Project (20 marks) in CIE.
- Any 10 experiments the students must do among the 12 experiments.

Suggested readings:
1. https://www.geeksforgeeks.org/robotics-introduction.
2. https://www.ohio.edu/mechanical-faculty/williams/html/PDF/IntroRob.pdf.
3. https://www.idtechex.com/en/research-report/new-robotics-and-drones-2018-2038-technologies-forecasts- players/584.
4. https://dronebotworkshop.com.

22EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	50 Marks
Credits	1

Course Objectives: This course aims to:

1. To acquire the knowledge on different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. To determine the characteristics of Transformers, dc, ac machines and switch gear components.

Course Outcomes: At the end of the course, the students are expected to:

1. Comprehend the circuit analysis techniques using various circuital laws and theorems.
2. Analyse the parameters of the given coil and measurement of power and energy in AC circuits
3. Determine the turns ration/performance parameters of single-phase transformer
4. Infer the characteristics of DC shunt motor different tests.
5. Illustrate different parts and their function of electrical components, equipment and machines.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	3	2	3	-	-	2	2	-	-	-	-	2

List of Laboratory Experiments / Demonstrations:

1. Verification of KCL and KVL.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.
4. Charging and discharging of Capacitor.
5. Determination of parameters of a choke or coil by Wattmeter Method.
6. Power factor improvement of single-phase AC System.
7. Active and Reactive Power measurement of a single-phase system using
   (i) 3-Ammeter method (ii) 3-Voltmeter method
8. Measurement of 3-Phase Power in a balanced system
9. Calibration of single-phase energy meter.
10. Verification of Turns/voltage ratio of single-phase Transformer.
11. Open Circuit and Short Circuit tests on a given single phase Transformer
12. Brake test on DC Shunt Motor
13. Speed control of DC Shunt Motor
14. Demonstration of Measuring Instruments and Electrical Lab components.
15. Demonstration of Low-Tension Switchgear Equipment/Components
16. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted to cover all five Course Outcomes.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

AICTE Model Curriculum with effect from AY 2024-25

B.E. - ELECTRONICS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)

SEMESTER – II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC05	Vector Calculus and Differential Equations	3	1	-	3	40	60	4
2	22PYC06	Electromagnetic Theory and Quantum Mechanics	3	-	-	3	40	60	3
3	22ECC01	Electronic Devices	3	-	-	3	40	60	3
4	22EGC01N	English	2	-	-	3	40	60	2
PRACTICAL									
5	22PYC09	Electromagnetic Theory and Quantum Mechanics Lab	-	-	3	3	50	50	1.5
6	22ECC05	Electronic Devices Lab	-	-	2	3	50	50	1
7	22EGC02N	English lab	-	-	2	3	50	50	1
8	22MEC01N	Engineering Graphics	-	1	3	3	50	50	2.5
9.	22MEC38N	Digital Fabrication Workshop	-	-	3	3	50	50	1.5
TOTAL			**11**	**2**	**13**	**27**	**360**	**440**	**19.5**
Clock Hours Per Week: 26									

L: Lecture D: Drawing **CIE: Continuous Internal Evaluation**

T: Tutorial P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

22MTC05

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS
(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

The objectives of this course are to:

1. To explain scalar and vector functions with its Physical interpretations.
2. To discuss vector line, surface and volume integrals.
3. To explain relevant methods to solve first order differential equations.
4. To discuss the solution of higher order Differential Equations
5. To learn Numerical solution of ODE and Engineering problems.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the vector differential operators to Scalars and Vector functions.
2. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
3. Calculate the solutions of first order linear differential equations.
4. Solve higher order linear differential equations.
5. Find solution of algebraic, transcendental and ODE by Numerical Methods.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	-	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	2
CO 5	2	2	2	2	-	-	-	-	-	-	-	1

UNIT-I

Vector Differential Calculus and multiple Integrals: Scalar and Vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities), Irrotational fields and Solenoidal fields, Double integral, Change of order of integration and Triple integrals.

UNIT-II

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Verification of Green's theorem in a plane (without proof), verification of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

UNIT-III

First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact equations, Linear equation, Bernoulli's equation, Clairaut's equation, Riccati's equation, Orthogonal trajectories, Rate of decay of Radio-active materials**.**

UNIT-IV

Higher Orders Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of variation of parameters, solution of Cauchy- Euler equation, LR and LCR circuits.

UNIT-V

Numerical Methods: Solution of Algebraic and transcendental equations by Bisection method, Regula-Falsi method Newton-Raphson method. Numerical Solutions of First Order Ordinary differential equations by Taylor's series method, Euler's method, Modified Euler's method and Runge-Kutta method of fourth order.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P.Bali and Dr. Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 9th edition, 2017.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.

e Resources:

1. https://archive.nptel.ac.in/courses/111/105/111105122/ (Week – 7 to Week 12)
2. NPTEL :: Mathematics - NOC:Advanced Calculus For Engineers (Week 5 and Week 6)

https://nptel.ac.in/courses/111107105 (Unit -2 and Unit-8)

22PYC06

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS
(ECE, EE(VLSID&T), & EEE)

Instruction	3L Hours per
week Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

Course Objectives: This course aims to:
1. Understand the fundamentals of wave nature of light.
2. Familiar with static and dynamic nature of electric and magnetic fields.
3. Acquire knowledge of lasers and fiber optics.
4. Learn basics of quantum mechanics and properties of solids.

Course Outcomes: Upon the completion of this course, the student will be able to:
1. Interpret the wave nature of the light.
2. Extend the laws of electric and magnetic fields for wireless communication.
3. Explain the principles of lasers and fiber optic communication.
4. Find the applications of quantum mechanics.
5. Identify semiconductors for engineering applications.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1	1	1	2	2	1	1	2	1	2
CO 2	3	2	2	1	1	1	1	1	1	2	2	3
CO 3	3	1	2	1	2	2	2	1	2	2	2	2
CO 4	2	2	1	1	1	1	1	1	1	2	1	2
CO 5	3	2	2	2	2	1	2	2	1	2	1	2

UNIT-I

Wave Optics: Huygen's principle – Superposition of waves – Interference of light by wavefront splitting and amplitude splitting –Interference in thin films (reflected light) – Newton's rings – Fraunhofer diffraction from a single slit – Double slit diffraction–Concept of N-slits–Diffraction grating. Polarization: Introduction–Malus's law –Double refraction –Nicol's prism–Quarter-wave plate and half-wave plate– Optical activity– Laurent's half shade polarimeter.

UNIT-II

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution– Divergence and curl of electrostatic field– Laplace's and Poisson's equations for electrostatic potential– Uniqueness theorem.

Magnetostatics: Biot-Savart law–Divergence and curl of static magnetic field –Equation for magnetic vector potential and its solution for given current densities – Ferromagnetic, paramagnetic and diamagnetic materials– B-H curve.

Electromagnetic Theory: Review of steady and varying fields–Conduction current and displacement current–Maxwell's equations in differential and integral forms–Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem – Skin depth.

UNIT-III

Lasers: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion – Ruby laser – He-Ne laser – Semiconductor laser –Applications of lasers in engineering and medicine.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers –Pulse dispersion – Fiber losses –Fiber optic communication system –Applications.

UNIT-IV

Quantum Mechanics: Introduction –Wave nature of particles – de-Broglie hypothesis –Physical significance of ψ –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave-packets –Uncertainty principle –Particle in infinite square well potential.

UNIT-V

Physics of Solids and Semiconductors: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level – Bloch's theorem for particles in a periodic potential –Kronig-Penney model – Origin of energy bands –Classification of solids: metals, semiconductors and insulators – Intrinsic and extrinsic semiconductors–Carrier generation and recombination–Carrier transport: diffusion and drift–P-N junction – Thermistor – Hall effect – LED – Solar cell.

Text Books:

1. B. K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M. N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S. L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and KiruthigaSivaprasath, *Modern Physics*, S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P. K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

22ECC01

ELECTRONIC DEVICES

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course Objectives:

This course aims to:

1. The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
2. The applications of diodes and transistors.
3. The various configurations and characteristics of transistors – BJT, JFET & MOSFET.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the understanding of the characteristic behaviour of Diodes.
2. Apply the acquired knowledge in the analysis of various diode circuits.
3. Compare and Contrast the characteristics of BJT in various configurations.
4. Analyze the operation and characteristics of JFET and MOSFET.
5. Choose an appropriate electronic device for a specific application.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1	1	1	1	1	2	1	1	1	2
CO 2	2	3	1	3	2	1	1	2	1	1	1	2
CO 3	1	2	1	1	1	1	1	2	1	1	1	2
CO 4	2	3	1	3	2	1	1	2	1	1	1	2
CO 5	1	3	1	2	2	1	1	2	1	1	1	2

UNIT - I

Semiconductor Diode Characteristics: The p-n junction Diode, Current equation, V-I characteristics, Diode resistance, Diode equivalent circuits, Temperature dependence, Transition capacitance, Diffusion capacitance, Diode switching times, Diode specifications, Zener diode – V-I characteristics, Zener diode as voltage regulator.

UNIT - II

Diode Applications: Diode as a circuit element: series diode configurations, parallel and series-parallel configurations, Clipping and clamping circuits, Clamping circuit theorem. Half wave, Full wave and Bridge Rectifiers - operation, ripple factor and efficiency calculations. Filters: L, C, LC and CLC filters with FWR – operation and ripple factor calculation.

UNIT - III

Bipolar Junction Transistor: Transistor: Construction and Operation, current components, Modes of operation, Early effect, BJT input and output characteristics: CB, CE, CC configuration. h-parameters, determination of h-parameters from transistor characteristics. BJT applications: BJT as an amplifier and as a switch.

UNIT - IV

Field Effect Transistor: Construction and Operation, Drain and transfer characteristics, Transconductance and drain resistance.

MOSFETs: Enhancement & Depletion mode MOSFETs, Drain and transfer characteristics. FET applications: FET as an amplifier and as a switch.

UNIT - V

Special Purpose Semi-Conductor Devices: Operation and V-I characteristics of UJT, SCR, Diac, Triac, Tunnel diode, Schottky diode, LED, Photodiode, Solar cell.

Text Books:

1. Millman and Halkias, "Electronic Devices and Circuits", 2nd Edition, McGraw Hill Publication, 2007.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.

Suggested Reading:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.

e-Resources:

1. https://archive.nptel.ac.in/course.html.

22EGC01N

ENGLISH

(BE/B.Tech - Common to all Branches)

Instruction	2LHours per Week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: Basic knowledge of English grammar and vocabulary.

Course Objectives: The course is taught with the objectives of enabling the students to:

1. Improve their understanding of communication skills while developing their usage of English for correct use of grammar and vocabulary.
2. Equip themselves with Reading Comprehension strategies and techniques.
3. Enhance their writing skills through paragraphs, précis and essays by using devices of cohesion and coherence.
4. Build appropriate, longer meaningful sentences for professional writing through formal letters and e-mails.
5. Demonstrate knowledge of drafting formal reports to define, describe and classify the processes by following a proper structure.

Course Outcomes:

After successful completion of the course the students will be able to:

1. Step-up the awareness of correct usage of English grammar and vocabulary by speaking fluently and comprehensively with a grip on communication skills.
2. Apply effective reading techniques through critical reading exercises to enhance quality of life and to support lifelong learning.
3. Develop their ability to write paragraphs independently on any context with cohesion, edit essays coherently while realizing brevity through précis writing.
4. Construct sentences clearly and comprehensively to write effective business letters and draft emails for a better professional communication.
5. Advance efficiency in writing, distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.

CO PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	1	1	1	2	3	3	2	3
CO 2	1	1	1	1	1	1	1	1	1	2	1	3
CO 3	1	2	1	1	-	1	1	1	1	3	1	3
CO 4	1	2	1	1	-	1	1	2	2	2	2	3
CO 5	1	2	1	2	1	2	2	2	3	3	2	3

UNIT-I Communication Skills:
Introduction, nature and importance of communication; Process of communication; Types of communication: verbal and non-verbal; Barriers to communication; Intrapersonal, Interpersonal communication; Understanding Johari Window.
Vocabulary & Grammar: The concept of Word Formation - Root words, Use of prefixes and suffixes to form derivatives, Standard abbreviations. Basic Sentences.
Reading Task I.

UNIT-II Reading Skills:
The Reading process, purpose, different kinds of texts; Reading Comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Practice in Critical Reading passages
Vocabulary and Grammar: Determiners. Use of Synonyms and Antonyms, Construction of Sentences.
Reading Task II.

UNIT-III Writing Skills II:
Paragraph Writing. – Structure and features of a paragraph; Essay writing, Cohesion and coherence. Techniques of writing précis.
Vocabulary & Grammar: Use of connectors and linkers, Tenses, Punctuation.
Reading Task III.

UNIT-IV Professional Writing Skills-1:
Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails, Email and Mobile etiquette.
Vocabulary and Grammar: Phrasal verbs, Misplaced modifiers, Subject-verb agreement.
Reading Task IV

UNIT-V Professional Writing Skills-2:
Report writing – Importance, structure, elements & style of formal reports; Writing a formal report. Writing for Blogs.
Vocabulary and Grammar: Words often Confused, Common Errors. Avoiding Ambiguity & Redundancy.
Reading Task V.

Text Books:

1. Sanjay Kumar & Pushp Lata, "English Language and Communication Skills for Engineers", Oxford University Press,2018.
2. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.

Suggested Readings:

1. Ashraf, M Rizvi, "Effective Technical Communication", Tata McGraw-Hill, 2006.
2. Michael Swan, "Practical English Usage", Oxford University Press, 4th Edition,2016.
3. Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice" 3rd Edition, Oxford University Press, 2015.

22PYC09

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS LAB
(ECE, EE(VLSID&T), & EEE)

Instruction	3P Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	1.5

Course Objectives:

This course aims to:

1. Apply the concepts of physics while doing experiments.
2. Understand the nature of the light experimentally.
3. Analyze the behavior of semiconductor materials and optoelectronic devices.

Course Outcomes:

After the completion of this course, the student will be able to:

1. Experiment with the concept of errors and find the ways to minimize the errors.
2. Demonstrate properties of light experimentally.
3. Find the applications of lasers and optical fibers in engineering applications.
4. Make use of semiconductor devices for practical applications.
5. Illustrate the working of optoelectronic devices.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	3	1	3	1	3	3	2	1	2
CO 2	3	2	1	2	2	2	1	2	2	1	1	3
CO 3	3	2	3	2	3	1	2	2	3	2	1	2
CO 4	3	3	2	2	2	1	2	3	2	1	1	3
CO 5	3	1	2	3	2	1	1	2	2	2	1	2

Experiments:

1. Error Analysis : Estimation of errors in the determination of time period of a torsional pendulum
2. Newton's Rings : Determination of wavelength of given monochromatic source
3. Single Slit Diffraction : Determination of wavelength of given monochromatic source
4. Diffraction Grating : Determination of wavelengths of two yellow lines of light of mercury lamp
5. Malus's Law : Verification of Malus's law
6. Double Refraction : Determination of refractive indices of O-ray and E-ray of given calcite crystal
7. Polarimeter : Determination of specific rotation of glucose
8. Laser : Determination of wavelength of given semiconductor laser
9. Optical Fiber : Determination of numerical aperture and power losses of given optical fiber
10. Energy Gap : Determination of energy gap of given semiconductor
11. P-N Junction Diode : Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
12. Thermistor : Determination of temperature coefficient of resistance of given thermistor
13. Hall Effect : Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen

14. LED : Study of I-V characteristics of given LED
15. Solar Cell : Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance

NOTE: A minimum of TWELVE experiments should be done.

22ECC05

ELECTRONIC DEVICES LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Students should have the knowledge of semiconductor fundamentals.

Course Objectives:

This course aims to:

1. The V-I characteristics of diodes and special semiconductor devices.
2. The design and performance evaluation of various diodes as rectifiers.
3. The characteristics of transistor in various configurations.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the characteristic behaviour of PN junction diode and Zener diode.
2. Design various non-linear wave shaping circuits using diodes for a given specification.
3. Analyse the performance of rectifiers with and without filters.
4. Examine the characteristics of BJT and FET in various configurations.
5. Compare the characteristics of special purpose semiconductor diodes.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	1	1	2	1	1	2	2	2	2	2
CO 2	2	2	1	1	2	1	1	2	2	2	2	2
CO 3	2	2	1	1	2	1	1	2	2	2	2	2
CO 4	2	2	1	1	2	1	1	2	2	2	2	2
CO 5	2	2	1	1	2	1	1	2	2	2	2	2

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode reverses characteristics and its application as voltage regulator.
3. Simple series clippers, parallel clippers and biased clipping circuits.
4. Clamping Circuits.
5. Performance evaluation of half wave rectifier without filters and with C & π section filters.
6. Performance evaluation of full wave rectifiers without filters and with C & π section filters.
7. BJT characteristics in Common Base configuration and measurement of h-parameters.
8. BJT characteristics in Common Emitter configuration and measurement of h-parameters.
9. BJT characteristics in Common Collector configuration and measurement of h-parameters.
10. Drain and Transfer characteristics of JFET in CS configuration and measurement of Transconductance and Drain resistance.
11. Emitter characteristics of UJT.
12. Characteristics of SCR.
13. Characteristics of Tunnel diode.
14. **Structured Enquiry:** Design a switching circuit using BJT and JFET and analyse its operation.

15. **Open ended Enquiry:** Design a LED running lights circuit for vehicles to avoid accidents in fog / rain condition.

Virtual lab Experiments (https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html**):**

1. Rectifiers without and with filters.
2. BJT characteristics in Common Base configuration and measurement of h-parameters.
3. BJT characteristics in Common Emitter configuration and measurement of h-parameters.

Note:

1. Wherever possible, Analysis and design of circuits shall be carried out using simulation tools.
2. A minimum of 12 experiments should be performed.

Suggested Reading:

1. Robert Diffenderfer, "Electronic Devices Systems and Applications", Cengage Learning India Private Limited, 2010.
2. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, "Basic Electronics, A Text - Lab Manual", 7th Edition, TMH 2001.
3. Mahesh Jain, "Practical semiconductors data manual No.3", BPB Publications, 1981.
4. Bharath Electronics Ltd., "Semiconductors data manual", IEC Publication 134, 1969.

22EGC02N

ENGLISH LAB

(BE/B.Tech - Common to all Branches)

Instruction	2 P Hours per Week
Duration ofSEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Basic Knowledge of English Communication.

Course Objectives: This course will introduce the students

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation through computer-aided multi-media instruction.
2. To the significance and application of word and sentence stress and intonation.
3. To sufficient practice in listening to English spoken by educated English speakers in different socio-cultural and professional settings.
4. To reading and speaking activities enabling them to critically interpret and respond to different texts and contexts, and produce speech with clarity and confidence.
5. To team work, role behaviour while developing their ability to use language appropriately, to discuss in groups and make presentations.

Course Outcomes:

After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Produce speech with clarity and confidenceusing correct word and sentence stress, and intonation.
3. Achieve improved ability to listen, understand, analyse, and respond to English spoken in various settings.
4. Read, interpret, and review a variety of written texts, contexts, and perform appropriately in different situations.
5. Design effective posters collaboratively through creative decisions, give presentations, and efficiently participate in Group discussions.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	1	1	2	1	3	3	3	3
CO 2	-	-	-	-	-	1	-	1	2	2	1	3	3	3	3
CO 3	-	-	-	-	-	1	1	1	2	1	1	2	3	3	3
CO 4	1	1	1	1	1	1	2	2	3	3	1	3	3	3	3
CO 5	-	1	1	1	1	2	2	2	3	3	2	3	3	3	3

Exercises

Computer-Aided Language Learning Lab

1. **Introduction to English Phonetics**: Introduction to English Phonetics and organs of speech.

2. **Sound system of English**: Speech sounds- Vowels andConsonants- structure of syllables (Introduction to syllables) - Basic phonetictranscription practice.
3. **Word and Sentence stress**: Rules of word stress -Primary stress, Secondary stress; Sentence stress (word emphasis in sentences) -Practice.
4. **Intonation**:Types of Intonation, Practice in Articulation – MTI-Errors in pronunciation.
5. **Listening skills**: understanding Listening- Practice in Listening comprehension texts.

Interactive Communication Skills Lab

1. **JAM-** Ice Breaking, Speaking Activity**.**
2. **Role play/Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
3. **GroupDiscussions -** Dynamics of a Group Discussion, Group Discussion Techniques,Non-Verbal Communication.
4. **Read and Review** - Preparation for active reading and instructing the students to cultivate effective reading habits to read select texts, review and write their responses.
5. **Poster presentation –** Theme, poster preparation, team work and presentation.

Text Books:

1. T Balasubramanian, "A Textbook of English Phonetics for Indian Students", Macmillan, 2nd Edition, 2012.
2. J Sethi et al., "A Practical Course in English Pronunciation (with CD)", Prentice Hall India, 2005.
3. Priyadarshi Patnaik, "Group Discussions and Interview Skills", Cambridge University Press Pvt. Ltd., 2nd Edition, 2015.
4. Aruna Koneru, "Professional Speaking Skills", Oxford University Press, 2018.

Suggested Reading:

1. "English Language Communication Skills – Lab Manual cum Workbook", Cengage Learning India Pvt. Ltd., 2022.
2. KN Shoba& J. Lourdes Javani Rayen."Communicative English – A workbook", Cambridge University Press, 2019.
3. Sanjay Kumar& Pushp. Lata. "Communication Skills: A Workbook. Oxford University Press", 2019.
4. Veerendra Mishra et al. "English Language Skills: A Practical Approach", Cambridge University Press, 2020.

Suggested Software:

1. K-VAN Multi-Media Language Lab
2. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
3. Digital All Orell Digital Language Lab (Licensed Version).

22MEC01N

ENGINEERING GRAPHICS

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Prerequisite: Nil

Course Objectives:

This course aims to:

1. Get exposure to a cad package and its utility.
2. Understand orthographic projections.
3. Visualize different solids and their sections in orthographic projection
4. Prepare the student to communicate effectively by using isometric projection.
5. Prepare the student to use the techniques, skills, and modern tools necessary for practice.

Course Outcomes:

Upon completion of this course, student will be able to:

1. Become conversant with appropriate use of CAD software for drafting and able to draw conic sections.
2. Understand orthographic projections of points and straight lines.
3. Draw the projections of planes.
4. Draw and analyze the internal details of solids through sectional views.
5. Create an isometric projections and views.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	2	2	-	1	2	3	1	3
CO 2	3	2	2	1	2	2	-	1	2	2	1	2
CO 3	3	3	2	1	2	2	-	1	2	2	1	2
CO 4	3	3	3	2	2	2	-	1	2	2	1	2
CO 5	3	2	2	1	2	2	-	1	2	2	1	2

List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning, documentation and practice exercises using Auto CAD software.
2. Construction of Conic Sections by General method.
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane & inclined to both the planes (without traces and mid-point)
5. Projection of planes: Perpendicular planes
6. Projection of planes: Oblique planes
7. Projection of solids: Simple position
8. Projection of solids: Inclined to one plane
9. Sections of solids: Prism, pyramid in simple position
10. Sections of solids: Cone and Cylinder in simple position
11. Isometric projections and views
12. Conversion of isometric views to orthographic projections and vice-versa.

Text Books:

1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishers, 2012.
2. K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt.Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson, 2009.

K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011

22MEC38N

DIGITAL FABRICATION WORKSHOP

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Nil

Course Objectives:

This course aims to:

1. Give a feel of Engineering Practices and develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive and team work attitude to get things right the first time.
3. Provide basic knowledge of steel, plastic, composite, and other materials for suitable applications.
4. Study of principle and hands on practice on techniques of fabrication, manufacturing, and allied skills.
5. Advance important, hard and pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes:

Upon completion of this course, students will be able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in carpentry, house wiring and plumbing.
3. Make a given model by using workshop trades like carpentry, plumbing, House wiring and 3d modeling using solid works software for Additive Manufacturing.
4. Perform pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
5. Conceptualize and produce simple device/mechanism of their choice.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	-	-	-	1	-	-	-	1
CO 2	1	-	1	-	-	-	-	-	-	-	-	1
CO 3	1	-	1	-	-	1	-	-	-	-	-	1
CO 4	1	-	1	-	-	1	-	-	-	--	-	1
CO 5	2	2	2	1	3	1	-	1	1	2	-	2

Lab Experiments

Group 1: Workshop Practice

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dovetail joint on the given wooden piece according to the given dimensions.
3. (a)Wiring of one light point controlled by one single pole switch, a threepin socket controlled by a single switch

3 (b)Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a threepin socket.

4 Stair case wiring Wiring of one light point controlled from two different places independently using two 2way switches.

5 To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings, and bends.
6 To connect the GI pipes as per the given diagram using, Coupling, Unions, reducers, and bends. To connect the GI pipes as per the given diagram using shower, tap, and valves and demonstrate by giving water connection.

Group 2: Additive Manufacturing /3D Printing

1. To Study the methods of Additive manufacturing process using a 3D printer.
2. To create a 3D CAD model of a door bracket using a modelling software.
3. To print a door bracket using an extruder type 3D printer.
4. To create a 3D CAD model using Reverse engineering.
5. Engraving, Drilling and Cutting operations on printed circuit boards using CNC PCB Mate.
6. To design an innovative component using the CAD software./print the selected innovative component by the student using a 3D printer.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology.
2. Oliver Bothmann, 3D Printers: A Beginner's Guide, January 1, 2015.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
AICTE Model Curriculum with effect from AY 2025-26

B.E. - ELECTRONICS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)

SEMESTER – III

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC19	Complex Variables and Special Functions	3	-	-	3	40	60	3
2	22EVC01	Analog Circuits Analysis	3	-	-	3	40	60	3
3	22EVC02	Digital Electronics	3	-	-	3	40	60	3
4	22ECC03N	Network analysis and synthesis	3	1	-	3	40	60	4
5	22ITC24	Data Structures using C	3	-	-	3	40	60	3
6	22ECC04	Signals and Systems	3	-	-	3	40	60	3
PRACTICALS									
7	22EVC03	Analog and Digital Circuits Lab	-	-	2	3	50	50	1
8	22ITC25	Data Structures using C Lab	-	-	2	3	50	50	1
9	22ECC06	Network analysis and synthesis Lab	-	-	2	3	50	50	1
10	22EVI01	MOOCs / Training / Internship	3-4 Weeks / 90 Hours				50	-	2
Total			**18**	**1**	**6**	**27**	**440**	**510**	**24**
Clock Hours Per Week: 25									

L: Lecture D: Drawing **CIE: Continuous Internal Evaluation**

T: Tutorial P: Practical/Project Seminar/Dissertation SEE: Semester End Examination

22MTC19

COMPLEX VARIABLES AND SPECIAL FUNCTIONS

Instruction	3 L per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To discuss the power series solution of differential equations.
2. To discuss the properties of Legendre's Polynomials.
3. To discuss the properties of Bessel's functions
4. To learn Differentiation and Integration of complex valued functions.
5. To evaluate real and definite integrals.

Course Outcomes:

Upon completing this course, students will be able to:

1. Solve differential equations by using series solution method
2. Express polynomials as Legendre's functions.
3. Express polynomials as Bessel's functions.
4. Apply Cauchy's integral theorems to evaluate complex integrals.
5. Solve Real and Complex integrals by using Cauchy's residue theorems.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	-	-	-	-	-	-	-	2
CO 2	3	2	2	2	-	-	-	-	-	-	-	2
CO 3	3	2	2	2	-	-	-	-	-	-	-	2
CO 4	3	3	2	2	-	-	-	-	-	-	-	2
CO 5	3	3	2	2	-	-	-	-	-	-	-	2

UNIT – I

Series Solutions of Differential Equations: Ordinary point, singular point and regular singular point, series solution when **x=0** is an ordinary point of the equation, Frobenius method (Series solution when x=0 regular singular point).

Beta and Gamma functions: Beta function, Gamma function, relation between gamma and beta functions and related problems

UNIT-II

Legendre's Polynomial: Legendre's equation, Legendre's Polynomial of first kind (without proof), Rodrigue's formula, calculation of Legendre's polynomials, generating function, recurrence formulae and orthogonality of Legendre polynomials .

UNIT-III

Bessel's function: Bessel's equation, Bessel's function of the first kind of order n (without proof), recurrence formulae for Jn(x) and related problems, generating function. Sturm-Liouville problems, Orthogonality of Eigen functions.

UNIT-IV

Theory of Complex variables: Limit of a complex function, derivative of complex function, analytic function, Cauchy Riemann equations (Cartesian and polar forms), construction of Analytic functions by using Milne-Thomson's method. Harmonic function. Complex integration, Cauchy's theorem, Cauchy's Integral formula and its derivatives and related problems.

UNIT-V

Expansion of functions, Singularities & Residues: Taylor's and Laurent's series Expansions (without proof). Zeros of analytic function and types of singularities. Residues and Cauchy's Residue theorem. Evaluation of improper integrals. Bilinear transformations and conformal transformation.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
3. R.K.Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.

Suggested Reading:

1. N.P.Bali and Manish Goyal, Atext book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. James ward Brown, Ruel V. Churchill, "Complex variables an Applications", McGraw Hill Higher Education, 2013.

22EVC 01

ANALOG CIRCUITS ANALYSIS

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Student should have knowledge on Electronic Devices and Network Analysis.

Course Objectives:

This course aims to:

1. The Understand the applications of BJT & FET as an amplifier.
2. Analysis of BJT & FET in various configurations using small signal equivalent models and their frequency response.
3. Know concept of multistage, feedback amplifiers, power amplifier and their analysis

Course Outcomes:

Upon completion of this course, students will be able to:

1. Acquire the knowledge of BJT and FET behaviour in the design of various biasing and amplifier circuits.
2. Apply low and high frequency models of transistor in the analysis of single stage and multistage amplifiers.
3. Design and analyse feedback amplifier and oscillator circuits.
4. Compare and contrast different types of biasing, Multistage, Feedback and Power amplifiers.
5. Interpret a given analog circuit and evaluate its performance parameters by applying acquired knowledge.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	1	2	-	-	-	-	-	-	1	1
CO 2	2	2	1	2	-	-	-	-	-	-	1	1
CO 3	2	2	1	2	-	-	-	-	-	-	1	1
CO 4	2	2	1	2	-	-	-	-	-	-	1	1
CO 5	2	2	1	2		-	-	-	-	-	1	1

UNIT-I

Biasing

Transistor Biasing: BJT biasing techniques, stability factors, Bias compensation techniques, Thermal runaway, Thermal stability, BJT as an amplifier and as a switch.

JFET biasing: Zero current drift biasing, biasing of JFET, FET as an amplifier and as a switch.

UNIT-II

Single stage amplifiers

BJT Amplifiers: Analysis of BJT circuits using h-parameters in CB, CE and CC configurations - their comparison (approximate and exact analysis), Millers Theorem & its duality – application circuits, Frequency response of BJT

FET Amplifiers: Analysis of FET circuits using small-signal model for CS and CD configurations - their comparison. Frequency response of FET Amplifiers.

UNIT -III

Multistage amplifiers: Coupling schemes - RC coupling, Transformer coupling and Direct coupling; Analysis of CE-CE, CE-CB, CE-CC, CC-CC – Darlington pair.

Transistor at high frequencies: Hybrid π CE transistor model, CE short circuit current gain, Current gain with resistive load.

UNIT-IV

Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances. Method of analysis of feedback amplifiers, Analysis of Voltage series, voltage shunt, current series and current shunt feedback amplifiers.

UNIT -V

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC phase shift oscillator, Wein bridge oscillator, LC oscillator, Crystal oscillator.

Large Signal Amplifies: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, Class A resistive coupled and transformer coupled amplifiers, Class-B Push-pull and complementary symmetry amplifiers, Class AB operation. Power dissipation and efficiency calculations. Heat sinks.

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics – Analog and Digital Circuits and Systems", 2nd Edition, McGraw Hill Publication, 2010.
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 10th Edition, PHI, 2009.

Suggested Reading:

1. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
2. Donald Schilling, Charles Belove, Tuvia Apelewicz Raymond Saccardi, "Electronic Circuits: Discrete and Integrated", TMH, 3rd Edition, 2012.

25ECC02

DIGITAL ELECTRONICS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Electronic Device concepts.

Course Objectives: This course aims to:

1. Learn various concepts related to Digital Electronics and Boolean laws and Theorems.
2. Analyze various minimization techniques and Simplify the Boolean expressions,
3. Comprehend the concepts of various combinational, sequential logic Designs and logic families.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the basic concepts related to Digital Electronics and Boolean Theorems.
2. Apply the Minimization techniques for the simplification and implementation of logic functions using suitable gates namely NAND, NOR etc.
3. Design the Combinational Circuits such as Adders, Subtractors, Code Convertors, Decoders, Multiplexers, Magnitude Comparators etc.
4. Analyze the design of Sequential Circuits such as Flip flops, different types of Counters and Shift Registers and FSM.
5. Classify and describe the characteristics of different logic families.

CO-PO-PSO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1	1	1	-	-	-	-	-	-	2
CO 2	2	2	2	1	1	-	-	-	-	-	-	2
CO 3	3	3	3	2	1	-	-	-	-	-	-	2
CO 4	3	3	3	2	1	-	-	-	-	-	-	2
CO 5	3	2	2	2	1	-	-	-	-	-	-	2

UNIT – I: Introduction to Digital Electronics:

Introduction to Digital Systems and Switching Circuits, Number Systems: Decimal, binary, octal, hexadecimal number system and conversion, binary weighted codes, signed numbers, 1s and 2s complement codes, Binary arithmetic.

Boolean Algebra: Boolean laws, truth tables, Basic Theorems, Commutative, associative, distributive and DeMorgan's theorems, Realization of switching functions using logic gates. SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations.

UNIT - II: Minimization of Switching Functions:

Karnaugh map method, two, three and four variable Karnaugh maps, simplification of expressions, Quine-McCluskey Tabular Minimization Method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations. combinational circuits, multiple output functions.

UNIT-III: Combinational Logic Design:

Binary Adders and Subtractor, Code converters: Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display. Decoders, Encoders, Priority Encoders, Multiplexers, De-multiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

Unit-IV: Sequential Logic Design:
Latches, Flipflops, Difference between latch and flipflop, types of flipflops like S-R,D, JK, T, Master-Slave JK Flip Flop, Flip flop conversions, setup and hold times, Ripple and Synchronous counters, Shift registers. Finite State Machine- Moore and Mealey models, Implementation of sequence detector: state transition diagrams, state tables, state assignments, realization with different types of Flipflops.

Unit-V: **Logic Families and Introduction to Memories:**
Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series, CMOS open drain and high impedance outputs.

Memories (Qualitative treatment only): 6T SRAM - 1T and 3T DRAM - PROM – PAL – PLA.

Text Books:
1. Morris Mano M. and Michael D.Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6e", 6th Edition, Pearson May 2018.
2. Charles H. Roth, Jr. | Larry L. Kinney | Raghunandan G. H "Fundamentals of Logic Design" 1st edition, -Cengage Engineering,2020
3. Ronald J. Tocci, Neal S. Widmer & Gregory L. Moss, "Digital Systems: Principles and Applications", PHI, 12/e, 2016.

Suggested Reading:
1. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition, 2009.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11th Edition, 2015

22ECC03N

NETWORK ANALYSIS AND SYNTHESIS

Instruction	3 L + 1T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Prerequisite: Knowledge on Elements of Electrical Engineering.

Course Objectives:

This course aims to:

1. Make understand the concepts of Electric Circuits, Network Theorems and the Transient Analysis.
2. Make understand the concept of steady state and applying phasor analysis to AC circuits and analyzing magneticcoupled circuits.
3. Familiarize resonant circuits, two port network parameters, concept of Passive Filters and Network Synthesis.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Recall basics of electrical circuits with Nodal and Mesh analysis.
2. Illustrate electrical theorems for AC and DC Circuits.
3. Develop time domain and frequency domain analysis for circuits.
4. Analyze the electrical network and two port network parameters for different applications i.e., magnetic coupledcircuits, Filters.
5. Synthesize different network functions using Foster and Cauver form.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	1	1	1	1	2	3	1	3
CO 2	3	3	2	2	1	1	1	1	2	3	1	3
CO 3	3	3	2	2	1	1	1	1	2	3	1	3
CO 4	3	3	2	2	1	1	1	1	2	3	1	3
CO 5	3	3	3	2	1	1	1	1	2	3	1	3

UNIT - I

Network Theorems: Network reduction techniques, Super Nodal and Super Mesh Analysis, Superposition, Thevenin's and Norton's theorems, Reciprocity, Maximum Power Transfer, Compensation, Millman's, Duality and Tellegen's Theorems using dependent and independent sources.

UNIT - II

Transients: Introduction, Study of initial conditions, DC transients RL, RC circuits, RLC circuits, Formulation of integral, differential equations. Circuit analysis using Laplace Transform and inverse Laplace Transform, Pole-Zero Plots, Zero Input Response, Zero State Response.

UNIT - III

Steady State Analysis of AC Circuits: Phasor and vector representations, impedance and admittance, Average power, Apparent Power, Complex Power, Power triangle.

Coupled circuits: Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simplecircuits.

UNIT - IV

Frequency Domain Analysis: Concept of complex frequency, impedance and admittance functions, Series and parallelresonance, Q-factor, selectivity, bandwidth.

Two Port Networks: Z, Y, h, g, ABCD and Inverse ABCD parameters, equivalence of two port networks. Inter connection oftwo port networks.

UNIT - V

Filters: Introduction to Filters and classification of Filters (Low pass, High pass) and their design aspects.

Network Synthesis: Synthesis vs. analysis, Elements of circuit synthesis, Positive Real Functions: Definition, Necessary and sufficient conditions for a function to be positive real, Testing of driving point functions for positive realness. Synthesis of Foster and Cauer forms of LC, RC and RL networks.

Text Books:

1. William H.Hayt, Jr.,Jck E. Kemmerly and Steven M.Durbin, "Engineering Circuit Analysis", 8th Edition, McGrawHill, 2013.
2. Van Valkenberg M.E, "Network Analysis", PHI, 3rd Edition New Delhi, 2002.

Suggested Reading:

1. C. L. Wadhwai, "Network Analysis and Synthesis", 4th Edition, New Age Publications, 2016.
2. Sudhakar. A. and Shyam Mohan, S. P., "Circuits and Network", Tata McGraw Hill, New Delhi, 1994.

e-Resources:

1. https://nptel.ac.in/courses/108105159.
2. https://nptel.ac.in/courses/108102042.
3. https://nptel.ac.in/courses/117106108.

22ITC24

DATA STRUCTURES USING C
(Common to ECE, EE (VLSID&T), EEE)

Instruction	3 L Hours per week
Duration of Semester end Examination	3 Hours
Semester end Examination	60 Marks
CIE	40 Marks
Credits	3

Prerequisites: Programming and Problem Solving (22CSC01), Programming Laboratory (22CSC02).

Course Objectives:
This course aims to:
1. Discuss the basics of C Programming
2. Learn the usage of functions, arrays, pointers, and structures.
3. Familiarise with the concepts of Functions, Arrays, Pointers and Structures.
4. Introduce Stack, Queue and Linked lists data structures.
5. Explain the concepts of non-linear data structures like graphs and trees.

Course Outcomes:
After the completion of this course, the student will be able to:
1. Understand the basic concepts of C Programming language.
2. Understand the usage of functions, arrays, pointers, and structures.
3. Apply the concepts of Stacks and Queues in solving the problems.
4. Demonstrate the standard operations on Linked lists.
5. Explain tree traversals and graph traversal techniques.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1	1	1	-	-	-	-	-	-	1
CO 2	2	2	2	1	1	-	-	-	-	-	-	1
CO 3	2	2	2	1	1	-	-	-	-	-	-	1
CO 4	2	2	2	1	1	-	-	-	-	-	-	1
CO 5	2	2	2	1	1	-	-	-	-	-	-	1

UNIT -I
Introduction to C Language: C language elements, variable declarations and data types, operators and expressions, decision statements – If and switch statements, loop control statements – while, for, do-while statements, arrays.

UNIT -II
Functions: Types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, and Command line arguments.

UNIT -III
Basics: Algorithm specification, Data Abstraction, Performance Analysis
Stacks and Queues: Stack ADT, Queue ADT, Mazing Problem, Evaluation of Expressions

UNIT -IV

Lists: Singly Linked Lists, Dynamically Linked Stacks and Queues, Polynomials, Additional List Operations, Doubly Linked Lists

Hashing: Static Hashing

UNIT -V

Trees: Introduction, Binary Trees, Binary Tree Traversals, Heaps, Binary Search Trees

Graphs: Graph ADT, Elementary Graph Operations, Minimum Cost Spanning Trees.

Text Books:

1. Pradip Dey and Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan, "Fundamentals of Data Structures in C", Computer Science, 1993.

Suggested Reading:

1. A.K. Sharma, "Computer Fundamentals and Programming in C", University Press, 2nd Edition.
2. M.T. Somashekara, "Problem Solving Using C", 2nd Edition, PHI 2009 Pearson, 2013.
3. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata McGraw Hill.

e-Resources:

1. https://nptel.ac.in/courses/106105085.
2. https://archive.nptel.ac.in/courses/106/106/106106127.

22ECC04

SIGNALS AND SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Differential and Integral Calculus.

Course Objectives:

This course aims to:

1. Know Signals and systems representation/classification and also the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. Understand Sampling, time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transforms.
3. Understand concepts of convolution and correlation integrals.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Classify signals, systems and analyse the signals using Transform techniques.
2. Evaluate signal characteristics using time and frequency domain analysis.
3. Assess the system stability and causality using ROC and Pole-Zero Plot.
4. Describe the sampling process and analyse the DT Signal/systems using DTFS, DTFT and Z-Transform.
5. Apply the Convolution and correlation concepts for analysis of Signal and systems**.**

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	1	1	1	1	1	2	1	2
CO 2	3	2	1	1	1	1	1	1	1	2	1	2
CO 3	3	2	1	1	1	1	1	1	1	2	1	2
CO 4	3	2	1	1	1	1	1	1	1	2	1	2
CO 5	3	2	1	1	1	1	1	1	1	2	1	2

UNIT - I

Continuous Time Signals: Introduction to signals and systems, their representations and classification. Orthogonality of signals, Complete set of mutually orthogonal signals and Harmonic signals. Trigonometric Fourier series, Exponential Fourier series, Existence and Convergence. Symmetry conditions, Amplitude and Phase spectra. Power Spectral Density.

UNIT - II

Fourier Transforms: The direct and inverse Fourier transforms, Existence, Frequency spectrum and properties of Fourier Transforms, Fourier Transform of singularity functions and periodic signals. Energy Spectral Density.

UNIT - III

Laplace transforms: The Bilateral and unilateral Laplace transforms. Region of convergence and its properties. Properties of Laplace transform, Inverse Laplace transform, Laplace transform of causal periodic signals.

LTI System: Impulse response, System transfer function, Stability and Causality.

UNIT - IV

Discrete Time Signals: Sampling of continuous time signals. Sampling Theorem, DTS representation. Discrete Time Fourier Series, Discrete Time Fourier Transform and properties.

Z–Transform: The Direct Z-Transform, Region of convergence and its properties. S–Plane and Z–Plane correspondence, Z–Transform properties. Inverse Z–Transform.

Discrete LTI system: Impulse response and System transfer function. Stability and Causality.

UNIT - V

Convolution: Continuous convolution, Graphical interpretation and its properties. Discrete convolution and its properties.

Correlation: Continuous Cross correlation, Auto correlation and properties. Discrete Cross correlation, Auto correlation and properties.

Text Books:

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. Simon Haykin, "Signals and Systems", Wiley India, 5th Edition, 2009.
3. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawad, "Signals and Systems", PHI 2nd Edition, 2015.

Suggested Reading:

1. M. J. Robert, "Fundamentals of signals and systems", McGraw Hill, 2008.
2. A. Rajeswari, "Signals and Systems", Wiley India Pvt. Ltd, Publications 2021.

e-Resources:

1. https://nptel.ac.in/courses/108104100.
2. https://nptel.ac.in/courses/117101055.
3. https://nptel.ac.in/courses/117106108.
4. https://nptel.ac.in/courses/117104074.

22EVC03

ANALOG AND DIGITAL CIRCUITS LAB

Instruction	2P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Student should have knowledge on Electronic Devices lab and Network lab.

Course Objectives:

This course aims to:

1. The Understand the design of biasing and amplifiers.
2. Analysis of BJT & FET in various configurations using small signal equivalent models and their frequency response.
3. Know concept of logic gates and ICs

Course Outcomes:

Upon completion of this course, students will be able to:

1. Design of BJT/FET biasing circuits.
2. Experiment with single and multi-stage amplifiers.
3. Compare different performance of different oscillators.
4. Compare and contrast different types logic gates operation.
5. Implement different logic functions using different ICs.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	1	1	1	1	1	3	2	1	1
CO 2	3	3	3	1	1	1	1	1	3	2	1	1
CO 3	3	3	3	1	1	1	1	1	3	2	1	1
CO 4	3	3	3	1	1	1	1	1	3	2	1	1
CO 5	3	3	3	1	1	1	1	1	3	2	1	1

List of experiments

1. Design of a Common Emitter BJT amplifier and study of its frequency response.
2. Frequency response of two stage RC - Coupled Common Source FET amplifier
3. Design of a voltage shunt amplifier and study of its frequency response.
4. Desing of current series amplifier and study of its frequency response.
5. Design and implementation of RC Oscillator.
6. Design and implementation of LC Oscillator
7. Design of Class-B power amplifier.
8. Functional verification of logic gates using ICs.
9. Implementation of logic function using decoder IC.
10. Implementation of logic function using Multiplexer IC.
11. Implementation of code converter.
12. Implementation of BCD Adder.

- Structured enquiry: Design a Frequency Divider Circuit using ICs
- Open ended Enquiry: Design and implement a classroom sound monitoring system using BJTs and a 0.5W speaker.

22ITC25

DATA STRUCTURES USING C LAB
(Common for ECE, EE(VLSID&T), and EEE)

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisites: Programming and Problem Solving (22CSC01), Programming Laboratory (22CSC02).

Course Objectives:

The objectives of this course are to:

1. Acquaint with the IDLE and execution process of C Programs.
2. Learn the concepts of decision structures and Iteration structures in C.
3. Introduce Functions, Arrays, Pointers and Structures.
4. Explore linear data structures such as Stack, Queue and Linked lists.
5. Explain C programs to implement Trees and Graphs

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the execution of programs written in C language.
2. Illustrate decision and iterative structures.
3. Demonstrate the concepts of functions, arrays, structures and pointers.
4. Practice basic operations on linked lists, stacks, queues
5. Construct Trees, graphs and implement traversals.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	2	1	1	-	-	-	-	-	-	1
CO 2	2	2	2	1	-	-	-	-	-	-	-	1
CO 3	2	2	2	1	-	-	-	-	-	-	-	1
CO 4	2	2	2	1	-	-	-	-	-	-	-	1
CO 5	2	2	2	1	-	-	-	-	-	-	-	1

List of Experiments:

1. Using if and Switch Constructs Programs.
2. Demonstration of Looping Statements Problems.
3. Demonstration of Iterative and recursive Functions.
4. Demonstration of Structures and Union Programs.
5. Demonstration of Pointers and Arrays Programs.
6. Implementation of Stacks, Queues and standard operations.
7. Implementation of Single Linked Lists and standard operations
8. Implementation of Double Linked Lists and standard operations.
9. Construct a Binary Search Tree and implement tree traversals
10. Represent Graph and implement DFS and BFS traversals.

Text Books:

1. Pradip Dey and Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan, "Fundamentals of Data Structures in C", Computer Science, 1993.

Suggested Reading:

1. M.T. Somashekara, "Problem Solving Using C", 2nd Edition, PHI 2009 Pearson, 2013.
2. A.K. Sharma, "Computer Fundamentals and Programming in C", University Press, 2nd Edition.
3. E. Bala Guruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.

e-Resources:

1. https://nptel.ac.in/courses/106105085.
2. https://archive.nptel.ac.in/courses/106/106/106106127.

22ECC06

NETWORK ANALYSIS AND SYNTHESIS LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of basic Electrical components and Circuits.

Course Objectives:

This course aims to:

1. Understand the basic Concepts of Electrical Circuits, equipment and verify Network theorems.
2. Analyze Resonant circuits, Attenuators and passive filters.
3. Synthesize different network functions using Foster and Cauer forms.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Identify and measure the passive and active components using electronic equipment and apply Network theorems to AC and DC Circuits.
2. Determine and analyze two port network parameters.
3. Design and verification of attenuator and filters.
4. Simulation of different networks and circuits using the simulation software.
5. Synthesize different network functions using Foster and Cauer forms.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	1	1	1	1	1	1	1	1
CO 2	3	3	3	2	2	2	1	1	1	2	1	2
CO 3	1	2	1	1	1	1	1	1	1	1	1	1
CO 4	2	2	1	1	1	1	1	1	1	1	1	1
CO 5	1	1	1	1	1	1	1	1	1	1	1	1

List of Experiments:

1. Study of RLC components, Bread board, Regulated power supply, Function generator, CRO Measurement of R, L,C components using color code, multimeter and LCR - Q Meter.
2. Practice of Soldering and de -soldering for simple circuits on single and Multi-Layer PCBs.
3. Verification of Superposition theorem and Tellegen's theorem.
4. Verification of Maximum power transfer theorem. Verification of Reciprocity theorem.
5. Verification of Compensation theorem and Millman's theorem.
6. Verification of Transient Response in RC, RLCircuits.
7. Design and Verification of Series Resonance.
8. Determination of two-port network parameters (Z, Y, h, T).
9. Design and Verification of Constant-K low-pass filter.
10. Synthesization of network function using Foster and Cauer form.
11. **Structured Enquiry:** Design and Verification of Parallel Resonance.
12. **Open ended Enquiry:** Design and Verification of Constant-K High-pass filter.
13. **Virtual lab experiment:** Verification of Reciprocity Theorem – https://asnm-iitkgp.vlabs.ac.in/exp/verification-reciprocity-theorem/simulation.html

Note: Experiments are to be simulated by using simulation software.

Suggested Reading:

1. Thomas Petruzzellis, "Build Your Own Electronics Workshop", McGraw-Hill Companies, Inc., 2005.
2. A.M. Zungeru, J.M. Chuma, M. Mangwala, L.K. Ketshabetswe, "Handbook of Laboratory Experiments in Electronics and Communication Engineering", Vol. 2, 1st Edition, Notion press, 2017.

22EVI01

MOOCs / Training / Internship

Instruction / Demonstration / Training	3-4 Weeks / 90 Hours
Duration of Semester End Presentation	-
Semester End Evaluation	-
Continuous Internal Evaluation	50 Marks
Credits	2

Prerequisite: Knowledge of Basic Sciences and Engineering Science.

Course Objectives:
This course aims to:
1. Exposing the students to the industrial environment.
2. Create awareness with the current industrial technological developments relevant to program domain.
3. Provide opportunity to understand the social, economic and administrative considerations in organizations.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand Engineer's responsibilities and ethics.
2. Use various materials, processes, products and quality control.
3. Provide innovative solutions to solve real world problems.
4. Acquire knowledge in technical reports writing and presentation.
5. Apply technical knowledge to real world industrial/rural situations.

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Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	1	3	3	1	3	1	3	3
CO 2	1	1	1	3	3	1	2	1	1	1	1	1
CO 3	2	3	3	3	3	2	3	1	1	1	1	1
CO 4	1	1	1	1	1	3	1	1	3	3	1	1
CO 5	1	3	3	3	3	2	3	1	1	1	1	1

For implementation procedures and letter formats, Annexures I and III of Internship document may be referred.

Evaluation of Internship: The Industrial training / Internship of the students will be evaluated in three stages:
a) Evaluation by the Industry (in the scale of 1 to 10 where 1-Unsatisfactory; 10-Excellent).
b) Evaluation by faculty Mentor on the basis of site visit(s) or periodic communication (15 marks).
c) Evaluation through seminar presentation / Viva-Voce at the Institute by the constituted committee (25 marks).

Evaluation through Seminar presentation / Viva-Voce at the institute: Students shall give a seminar before an Expert Committee constituted by college (Director, HoD/Senior faculty, mentor and faculty expert from the same department) based on his/her training/internship carried out.

The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall be analyzed along with the Internship report.

Monitoring / Surprise Visits: During the internship program, the faculty mentor makes a surprise visit to the internship site, to check the student's presence physically. If the student is found to be absent without prior intimation to the concerned industry, entire training / internship may be canceled. Students should inform through email to the faculty mentor as well as the industry supervisor at least one day prior to avail leave.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
AICTE Model Curriculum with effect from AY 2025-26

B.E. - ELECTRONICS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)

SEMESTER – IV

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22ECC09	Control Systems	3	-	-	3	40	60	3
2	22EVC04	Linear Integrated Circuits	3	-	-	3	40	60	3
3	22EVC05	Verilog HDL	3	-	-	3	40	60	3
4	22EVC06	Digital VLSI Design	3	-	-	3	40	60	3
5	22ECC11	Probability Theory and Stochastic Process	3	-	-	3	40	60	3
6	22EEM01	Universal Human values –II understanding Harmony	-	1	-	-	50	-	1
7	22EGM01	Indian constitution and fundamental principles	2	-	-	2	-	50	Non-Credit
PRACTICALS									
8	22EVC07	HDL Lab	-	-	2	3	50	50	1
9	22EVC08	IC Applications Lab	-	-	2	3	50	50	1
10	22EVC09	Digital VLSI Design Lab	-	-	2	3	50	50	1
11	22EGC03	Employability skills	-	-	2	3	50	50	1
12	22EVU01	Up-skill Certification Course-I	-				25	-	0.5
Total			**17**	**1**	**8**	**29**	**475**	**550**	**20.5**
Clock Hours Per Week: 26									

L: Lecture D: Drawing **CIE: Continuous Internal Evaluation**

T: Tutorial P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

22ECC09

CONTROL SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: The student is expected to have knowledge of Laplace transform and electrical and electronic circuits.

Course Objectives:
This course aims to:
1. Introduce various control systems (Open and closed loop) and their equivalent mathematical models using block diagrams, signal flow graphs and state space techniques.
2. Analyze the time and frequency response of control system to access the transient response and steady state response.
3. Study different types of stability concepts in control systems and Design various controllers and compensators to improve the system dynamic performance.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Distinguish the closed-loop control systems from open-loop control systems and develop mathematical models in time domain (differential equations, state equations) and S-domain (Transfer function using Laplace transform).
2. Evaluation of transfer function from block diagram and signal flow graph by using block diagram reduction techniques and Mason gain formula, respectively.
3. Investigate the stability of control system via Routh-Hurwitz criteria, Root-locus method and Nyquist Plot.
4. Utilize standard test signals to analyze the time response of first and second-order control systems and frequency response analysis of the control system.
5. Design and develop various controllers and compensators to control the steady state error, stability and transient response.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	1	1	1	1	1	1	1	1	1	1
CO 2	3	3	1	2	1	1	1	1	1	1	1	1
CO 3	3	3	3	3	2	1	1	1	1	1	1	1
CO 4	3	3	2	3	2	1	1	1	1	1	1	1
CO 5	3	3	3	2	1	1	1	1	1	1	1	1

UNIT - I
Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems, Block diagram reduction and signal flow graphs, Mathematical modelling of a Mechanical system and conversion into Electrical system.

UNIT - II
Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second Order System with different inputs, Time domain Specifications. Types of Systems, Static error coefficients, Error series, PD, PI and PID controllers.

UNIT - III

Root Locus: Routh-Hurwitz criteria for stability, Root Locus Techniques, Analysis of typical systems using Root Locus Techniques, Effect of location of roots on system response.

UNIT - IV

Frequency Response Analysis: Frequency domain specifications, Bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams, Lead and Lag compensators.

UNIT - V

State Space Analysis: Concept of State, State Variable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability, Observability and Design of control systems using state variable feedback.

Text Books:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 5th Edition 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7th Edition, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5th Edition, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Edition Pearson, 2008.
3. Gopal Madan, "Digital control engineering" 1st Edition, New age publishers, 2008.

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ee90.

22EVC04

LINEAR INTEGRATED CIRCUITS

Instruction	3L Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

This course aims to:

1. To learn the basic building blocks of linear integrated circuits.
2. To study the applications of Operational Amplifiers.
3. To learn the theory and applications of active filters, PLL, 555 timers, ADC and DAC.

Course Outcomes:

1. Understand the building blocks of Op-Amp.
2. Implement the applications of Operational Amplifiers.
3. Analyse and Design of active filters and Oscillators.
4. Implementation of 555 IC Timer Applications.
5. Design and Implementation of ADC and DAC Converters.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	2	2	1	2	1	2	1	1
CO 2	3	3	2	1	2	1	1	2	2	2	1	2
CO 3	3	3	3	1	1	2	2	2	2	2	2	1
CO 4	3	3	3	2	1	1	2	2	2	1	1	1
CO 5	3	3	3	1	2	2	1	1	2	1	2	1

Unit I

Fundamentals and basic Applications of operational Amplifiers: Op-Amp block diagram, ideal and Practical Op-Amp Characteristics, Op-Amp and its features. Frequency response and compensation techniques. Op-Amp Applications: Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Difference Amplifier, Summing Amplifier, ideal and practical Integrator and differentiator.

Unit II

Linear Applications of Op-Amp: Comparator, Schmitt Trigger with and without reference voltage, Astable Multivibrator, Monostable Multivibrator, Triangular waveform generator. Op amp as an Instrumentation amplifier, Voltage to current and Current to Voltage converters with Floating and Grounded load, Sample and hold circuit, log and Anti log amplifiers using diode.

Unit III

Active Filters and Oscillators: Introduction, Analysis of Butterworth first order, second order lowpass and high pass filters, Band-pass filters, Band-stop filters, Notch filter, All-pass filter. RC Phase shift Oscillators and Wein bridge oscillator

Unit IV

Specialized LIC Applications:

555 Timer: Introduction and its functional diagram. Modes of operation: Monostable, Astable multivibrators, applications of 555 Timer. Function Generator: Analysis and Design of Function Generator using IC 8038. Voltage Controlled Oscillator: Operation and applications using IC 566. Phase Locked Loops: Introduction, Principles, Block diagram and Description of IC 565, Applications of PLL: frequency multiplication and frequency synthesis.

Unit V

Data Converters and Regulators: Data Converters: Introduction, specifications, DAC- Weighted Resistor, R-2R Ladder, ADC- Parallel Comparator, Successive Approximation and Dual Slope. Introduction, Analysis and design of regulators using 78XX and 723 monolithic ICs, Current limiting and Current foldback techniques using IC 723.

Textbooks:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
2. Roy Chowdhury D, Jain S.B., "Linear Integrated Circuits,"4/e, New Age International Publishers, 2010.

Suggested Reading:

1. K.R.Botkar, "Integrated Circuits," 10/e, Khanna Publishers, 2010.
2. David A.Bell, 'Op-Amp & Linear ICs', Oxford, 2013.
3. Sedra and Smith, "Micro Electronic Circuits", 6/e, Oxford University Press, 2009.

22EVC05

VERILOG HDL

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Digital Electronic concepts.

Course Objectives:
This course aims to:
1. Learn various concepts related to Verilog HDL.
2. Analyze and identify the suitable Abstraction level for a particular digital design.
3. Comprehend the various Verilog Constructs and use them to write efficient codes.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the basic concepts related to Verilog HDL.
2. Analyze the Verilog construct for gate Level and Data Flow (RTL) and write codes using those modeling styles.
3. Design Combinational and Sequential circuits using behavioral modeling.
4. Write the codes more effectively using Verilog tasks, functions, UDPs and switch Level modeling levels
5. Generate the Logic Synthesis with the Verilog HDL.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1	1	3	-	-	-	-	-	-	3
CO 2	2	3	2	3	3	-	-	-	-	-	-	3
CO 3	3	3	2	3	3	-	-	-	-	-	-	3
CO 4	2	3	2	3	3	-	-	-	-	-	-	3
CO 5	1	1	1	2	3	-	-	-	-	-	-	3

UNIT – I: Introduction to Verilog HDL:
Verilog as HDL, Evolution of CAD, Importance of HDLs, Design Flow, Popularity of Verilog HDLs. Design Methodologies, Module, Instances, components of Simulation, Design and Stimulus blocks.
Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks.
Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing.

UNIT - II: Gate level and Data Flow Modelling:
Gate Level Modeling: Introduction, Gate Primitives, Gate Types, Buffer gates, Array instances, Gate delays, Rise, Fall and Turnoff delays, Min/Typ/Max values. Digital logic circuits Examples with Gate Level modelling.
Data Flow Modeling: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators. Digital logic circuits examples with Data Flow modelling

UNIT-III: Behavioral Modeling:
Structured Procedures, Initial, Always Construct, Procedural Assignment, Timing Control, Conditional Statements, Multiway Branching, Loops, Sequential and parallel blocks and Generate blocks. Digital logic circuits examples with Behavioral Modelling.

Unit-IV: Advanced Verilog topics:
Functions, Tasks: Introduction, Function, Tasks, declaration, Automatic (Re-entrant) Tasks, Functions.
User-Defined Primitives (UDP): Basics of UDP, combinational UDP, Sequential UDP,
Switch Level Modeling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Examples with SLM

Unit-V: Logic Synthesis with Verilog:
Logic Synthesis, Verilog HDL Synthesis, Synthesis Design flow, Modelling Tips for Logic Synthesis
Verilog Models for Memories: Static RAM Memory, Dynamic RAM memories.

Text Books:
1. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2010.
2. T.R. Padmanabhan and B. Bala Tripura Sundari, "Design through Verilog HDL", WSE, IEEE Press 2008.

Suggested Reading:
1. Morris Mano M. and Michael D.Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6e", 6th Edition, Pearson May 2018.
2. Thomas and Moorby, "The Verilog Hardware Description Language", kluwer academic publishers, 5th edition, 2002.

22EVC06

DIGITAL VLSI DESIGN

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: MOS Basics, electronic circuit analysis and Digital Electronics.

Course Objectives:

This course aims to:

1. To train the students in the design of basic digital logic cells.
2. To familiarize students with various digital logic styles.

Course Outcomes:

Student will be able to:

1. Apply different Models of the MOSFET for a given application context.
2. Design Combinational gates / leaf-cells as per the given specifications.
3. Differentiate between various CMOS logic design styles
4. Differentiate and Choose between Static and Dynamic CMOS Circuits
5. Design CMOS sequential circuits.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1	1	3	-	-	-	-	-	-	3
CO 2	2	3	2	3	3	-	-	-	-	-	-	3
CO 3	3	3	2	3	3	-	-	-	-	-	-	3
CO 4	2	3	2	3	3	-	-	-	-	-	-	3
CO 5	1	1	1	2	3	-	-	-	-	-	-	3

Unit-I

Basic Electrical Properties of MOS circuits: Evolution of IC Design, MOS transistor operation in linear and saturated regions, MOS transistor threshold voltage, MOS switch and inverter, latch-up in CMOS inverter; wiring capacitances;

Unit-II

CMOS inverter properties - Robustness:Switching Threshold, Noise Margins. Dynamic performance: Computing Capacitances, Inverter delay times; static and dynamic power dissipation, MOSFET scaling - constant-voltage and constant-field scaling;

Unit-III

Static CMOS Combinational Circuit: Static CMOS Gates, Ratioed Logic, Logic Effort, Design of arithmetic building blocks: adders – static & dynamic, multipliers - serial & parallel, barrel multipliers, area-time tradeoff, power consumption issues. Layout Techniques for complex Combinational gates.

Unit-IV

Dynamic CMOS Combinational Circuits: Steady-State behavior of Dynamic Gate Circuits, Speed and Power Dissipation of Dynamic Logic, Noise considerations in dynamic design, charge sharing, cascading dynamic gates, domino logic, np-CMOS logic, problems in single- phase clocking, two-phase non-overlapping clocking scheme.

UNIT-V

CMOS Sequential Logic Circuits: Timing Metrics for Sequential Circuits, Classification of Memory Elements, Static Latches and Registers, The Bistability Principle, Multiplexer-Based Latches, Master-Slave Edge-Triggered Register, Static SR Flip-Flops, Dynamic Latches and Registers, True Single-Phase Clocked Register (TSPCR), Sense-Amplifier Based Registers.

Text Books:

1. J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, 2nd ed., PHI, 2003
2. S.M. Kang and Y. Leblevici, CMOS Digital Integrated Circuits Analysis and Design, 3rd ed., McGraw Hill, 2003
3. N.H.E. Weste and K. Eshraghian, Principles of CMOS VLSI Design - a System Perspective, 2nd ed., Pearson Education Asia, 2002.

Suggested Reading:

1. Behzad Razavi, “CMOS Analog IC Design”-2nd edition , McGraw Hill.

22ECC11

PROBABILITY THEORY AND STOCHASTIC PROCESS
(Common to ECE, EE(VLSID&T))

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of probability.

Course Objectives:
This course aims to:
1. Apply the knowledge of probability, random variables and random processes gained in this course to several complex engineering problems.
2. Model a random variable/process into a mathematical model. Compute probability distributions and estimate statistical / time variations.
3. Learn the basic concepts of noise, characterize the noise and estimate the response of a linear system to a random process such as noise.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand fundamentals of Probability and the concept of random variables.
2. Characterize random distributions.
3. Determine the Spectral and temporal characteristics of Random Signals.
4. Analyze the Noise in Communication systems.
5. Estimate the auto-correlation and power spectral density of linear system response.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1	1	1	1	1	2	1	1	1	2
CO 2	2	3	1	3	2	1	1	2	1	1	1	2
CO 3	1	2	1	1	1	1	1	2	1	1	1	2
CO 4	2	3	1	3	2	1	1	2	1	1	1	2
CO 5	1	3	1	2	2	1	1	2	1	1	1	2

UNIT - I
Probability and Random Variables: Review of Probability, Joint and Conditional Probability, Total Probability, Bayes' Theorem, Independent Events, Concept of Random Variables, Continuous Distributions: Uniform, Exponential, Gaussian and Rayleigh Distributions. Discrete Distributions: Binomial and Poison Distributions. Conditional and Joint Distributions and Density Functions.

UNIT - II
Operations on Single Random Variables: Expectation, Moments about Origin and Central Moments, Chebychev's Inequality and Markov's Inequality. Functions that give Moments: Characteristic Function, Moment Generating Function, Central Limit Theorem (proof not expected).
Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Jointly Gaussian Random Variables and Properties.

UNIT - III

Stochastic Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes. Stationarity and Independence: Distribution and Density Functions, Wide-Sense Stationarity, Strict-Sense Stationarity, Time Averages and Ergodicity. Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Function, Gaussian Random Process.

Stochastic Processes – Spectral Characteristics: Power Density Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum and its Properties. Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT -IV

Noise: Thermal Noise, White Noise and Colored Noise, AWGN, Noise Temperature, Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded Systems.

UNIT - V

Linear System with Random Inputs: Random Signal Response of Linear Systems: System Response, Convolution, Mean and Mean Squared Value of System Response, Auto Correlation of Response and Cross Correlation functions of Input and Output. Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

Text Books:

1. Peyton Z.Peebles JR., "Probability Random Variables and Random Signal Principles", Tata McGraw Hill, Edition, 4/e, 2002.
2. Herbert Taub, Donald Schilling and Goutam Saha, "Principles of Communication", Tata McGraw Hill, 4th Edition, 2017.
3. Athanasios Papolis and S.Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", McGraw Hill, Inc., 4th Edition, 2006.

Suggested Reading:

1. Henry Stark and John W Woods, "Probability & Random Process with Application to Signal Processing", Pearson Education, 3rd Edition, 2014.
2. Simon Haykin, "Communication Systems" John Wiley & Sons, Inc. 5th Edition, 2009.
3. B.P.Lathi, "Signals, Systems & Communications", B.S.Publications, 2003.

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ma97.
2. https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014.

22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

(BE / B.Tech – Common to all Branches)

Instruction	1 T Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Introduction:

This course discusses the role of human values in one's family, in society and in nature. During the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

Prerequisite: Universal Human Values–I Student Induction Program.

Course Objectives:

This course aims to:

1. Understand the concept of universal human values.
2. Cultivate empathy and respect for diversity.
3. Inspire the social responsibility and global citizenship.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Become familiar about themselves, and their surroundings (family, society, nature).
2. develop empathy and respect for diversity by gaining an appreciation for different cultures, perspectives and identities
3. Exhibit responsible and ethical behavior by adhering to principles of integrity, honesty, compassion, and justice.
4. Recognize their role as global citizens.
5. Exhibit a sense of social responsibility.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	1	1	1	2	1	1	1	1
CO 2	1	1	1	1	1	1	1	1	1	1	1	1
CO 3	1	1	1	1	1	1	1	1	1	1	1	1
CO 4	1	1	1	3	2	1	1	2	1	1	1	1
CO 5	1	1	1	2	2	1	1	1	1	1	1	1

Module -1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration.
- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.

- Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module- 2: Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module-3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- Understanding the meaning of Trust; Difference between intention and competence.
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers.
  b. At the level of society: as mutually enriching institutions and organizations.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

Module -4: Understanding Harmony in Nature and Existence - Whole existence as Coexistence.

- Understanding the harmony in Nature.

- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- Holistic perception of harmony at all levels of existence.
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

Mode of Conduct (L-T-P-C 0-1-0-0)

- While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
- In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection, and self-exploration.
- Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentors, in a group sitting.
- **Tutorials (experiments or practical) are important for this course**. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included.
- The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to the development of commitment, namely behaving and working based on basic human values.
- **It is advised to share the experience of the Faculty to the class in a capsule form.**
- **Involve more in evaluating the student by different activities with proper RUBRCCS**

Assessment:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation.

Example:

Module-1:	10 M
Module -2:	10 M
Module- 3:	10 M
Module-4:	10 M
Attendance & Attitude:	10 M

The overall pass percentage is 50%. In case the student fails, he/she must repeat the course.

Textbooks:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics" 2nd Revised Edition, Excel Books, New Delhi, 2022.
2. R R Gaur, R Asthana, G P Bagaria "Teacher's Manual for A Foundation Course in Human Values and Professional Ethics", nd Revised Edition, Excel Books, New Delhi, 2022.

Reference Books:

1. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth.

e-Resources:

1. https://nptel.ac.in/courses/109104068.

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(BE / B.Tech – Common to all Branches)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	No Credits

Prerequisite: Basic awareness of Indian Constitution and Government.

Course Objectives:

This course aims to:

1. Understand the history of framing of the Indian Constitution.
2. Awareness on Fundamental Rights, Duties and Directive Principles of State Policy.
3. Explore the organization of Union Government, and functions of President and Prime Minister.
4. Gain an insight into the inter-functionality of Union Legislature and Judiciary
5. Educate on the local governance and problems in development of rural and urban areas.

Course Outcomes:

After successful completion of the course the students will be able to:

1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
4. Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
5. Evolve the development of the local governments in India and assess the role of Collector in district administration.

Course Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	1	-	-	1	1	1	1	-	-	-
CO 2	-	-	2	-	-	3	2	2	1	-	-	-
CO 3	-	-	1	-	-	1	1	-	-	-	-	-
CO 4	-	-	1	-	-	1	1	-	-	-	-	-
CO 5	-	-	2	-	-	3	2	1	1	-	-	-

Unit-I

Constitutional History and Framing of Indian Constitution:

East India Company rule (1757-1857): Social, Economic, Political and Administrative impact of Company rule in India. British Rule (1858-1947): Indian National Movement, Government of India Acts 1909, 1919 and 1935, and Indian Independence Act 1947. Framing of the Indian Constitution: Constituent Assembly, Preamble and Salient Features.

Unit-II

Fundamental Rights, Duties and Directive Principles of State Policy:

The Fundamental Rights**:** Features and significance of Rights. Fundamental Duties: Importance and the legal status of Duties. Directive Principles of State Policy: Socialist, Gandhian and Liberal-intellectual principles, importance and relevance.

Unit-III

Union Government and its Administration:

Federalism: Division of legislative and financial powers between the Union and the State. Union Executive: Role and position of President, Prime Minister and Council of Ministers. Emergency Provisions: National Emergency, Constitutional Emergency and Financial Emergency.

Unit-IV

Union Legislature and Judiciary:

Union Legislature: Parliament of India-Composition and functions of Parliament, and Parliamentary Committees. Union Judiciary: Supreme Court of India-Composition and Functions.

Unit-V

Local Self Governments:

Rural Local Governments: Zilla Parishad- CEO and functions of Zilla Parishad, Mandal Parishad- Role of Elected and Officials, Gram Panchayat- Sarpanch, Secretary and Gram Sabha. Urban Local Governments: Structure and functions of Municipalities and Municipal Corporations. District Collector: Powers and functions of Collector.

Text Books:

1. Sastry Ravindra, (Ed), "Indian Government & Politics", Telugu Akademy, 2nd edition, 2018.
2. "Indian Constitution at Work", NCERT, First edition 2006, Reprinted in 2022.

Suggested Reading:

1. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. Granville Austin, "The Indian Constitution: The Cornerstone of a Nation", OUP, 2nd Edition, 1999.
4. M.V. Pylee, "India's Constitution", S. Chand Publishing, 16th Edition, 2017.
5. Rajeev Bhargava (ed), "Politics and Ethics of the Indian Constitution", OUP, 2008.

e-Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

25EVC07

HDL LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Concepts of Digital Electronics and C language.

Course Objectives:

This course aims to:

1. Simulate and synthesize combinational logic circuits.
2. Simulate and synthesize sequential logic circuits.
3. Learn and implement procedure for any digital system design.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Design a Digital circuit using Verilog HDL.
2. Understand various abstraction levels of a digital design.
3. Verify the functionality of a design using Test bench.
4. Understand the flow of the HDL tool for combinational logic and sequential circuits.
5. Digital verification on FPGA for Cmbinational and sequential logic circuits.

,,Course Articulation Matrix

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	2	3	-	-	-	2	2	-	1
CO 2	2	2	2	2	3	-	-	-	2	2	-	1
CO 3	2	3	3	2	3	-	-	-	2	2	-	1
CO 4	2	3	3	3	3	-	-	-	2	2	-	1
CO 5	3	3	3	3	3	-	-	-	2	2	-	1

List of Experiments:

Write a Verilog HDL code to Simulate and synthesize the following in Gate level, Data flow and Behavioral Modeling styles.

1. Logic Gates.
2. Binary Adders and Subtractors.
3. Multiplexers and De-multiplexers.
4. Encoders, Decoders and Comparator.
5. Implementation of logic function using Multiplexers and Decoders.
6. Code Converter : Binary to Gray, Gray to Binary, BCD to SSD.
7. Arithmetic and Logic Unit.
8. Flip-Flops: SR, D, T, JK.
9. Counters and Shift register.
10. FSM.
11. Tasks and Functions.
12. UDPs.
13. NAND, NOR gate, Adders and MUX using Switch Level Modelling.
14. Implementation of SSI Circuits on FPGA.
15. **Structured Enquiry:** Design of a High-Speed Adders.
16. **Open ended Enquiry:** Design of Digital System for real time applications.

17. **Virtual Lab Experiments: V**erify the truth table of RS, JK, T and D flip-flops using NAND & NOR gates**.** https://de-iitr.vlabs.ac.in/exp/truth-tables-flip-flops/simulation.html

Note: A minimum of 10 experiments should be performed.

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2008.

22EVC08

IC APPLICATIONS LAB

Instruction	2L Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

This course aims to:

1. To measure the characteristics of Op Amp and implementing the arithmetic circuits, filters, oscillators using Op Amp.
2. To analyse the operation and implementation of circuits using IC 566, IC 723, IC 555.
3. To know and verify the concepts of data converters.

Course Outcomes:

1. Measure the characteristics of Op-Amp
2. Demonstrate the circuits of Op-Amp for various applications
3. Implement the arithmetic circuits, filters, oscillators
4. Implementation of voltage regulators
5. Design and analyse the data converters

Course Articulation Matrix

PO /PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	3	2	3	1	1	2	1	2	1	1
CO 2	3	3	3	2	3	1	2	2	2	1	1	2
CO 3	2	3	2	1	2	2	1	1	2	2	2	2
CO 4	3	3	2	2	2	1	2	1	2	1	2	-
CO 5	2	2	2	3	2	2	1	1	1	2	1	2

Lab Experiments:

1. Measurement of Op-Amp parameters.
2. Voltage Follower, Inverting and Non-Inverting Amplifiers using Op-Amp.
3. Arithmetic Circuits: Summer, Subtractor, Integrator and Differentiator using Op-Amp.
4. Active filters: LP, HP and BP using Op-Amp.
5. Astable, Monostable multi vibrators using Op-Amp.
6. Triangle and Square wave generators using Op-Amp.
7. Oscillators using Op-amp.
8. Voltage Controlled Oscillator Using IC 566.
9. Low and High Voltage Regulators using IC 723.
10. Astable, Monostable multi vibrators using IC 555 Timer.
11. Binary Weighted and R-2R Ladder network ADC.
12. Successive Approximation Resistor and Dual slope Counter method DAC.

Reference Book: Laboratory Manual.

22EVC09

DIGITAL VLSI DESIGN LAB

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite:
Digital electronics, MOS Fundamentals, Electronic Design Analysis.

Course Objectives:
This course aims to:
1. To train students to design basic combinational and sequential logic blocks at transistor level i.e. leaf-cells of a library.
2. To train students to design and characterize a given digital block.
3. To train students to develop layouts of the leaf cells for a standard cell library.

Course Outcomes:
At the end of the course student will be able to:
1. Demonstrate expertise in using the tool to design and simulate a given leaf cell.
2. Perform appropriate simulations to characterize the designed block.
3. Develop Layout for a specified standard cell library.
4. Develop GDS following all checks like DRC, LVS, Post Layout, EMI, EMC,etc.
5. Write a professional Report to conclude the experiment.

Course Articulation Matrix

PO /PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	2	3	1	1	3	3	1	1	1
CO 2	3	3	3	3	3	1	1	1	1	1	1	1
CO 3	3	2	3	3	3	2	1	3	3	1	1	1
CO 4	3	3	3	3	3	2	1	3	3	1	1	1
CO 5	3	2	2	3	1	1	1	3	3	3	3	3

Experiments (Simulation Based):
1. Static CMOS Logic Gates
2. Ratioed Logic Gates
3. Dynamic Logic Gates
4. Adders
5. SR-Latch
6. D-Flip flop
7. Dynamic D-Flip Flop
8. Memory Cell

Experiments (Simulation and Layout Leading to GDS)
1. Static CMOS Inverter
2. Static CMOS NAND Gates

3. Transmission Gate based Mux
4. Implementation of Half Adder using Mux.

Reference:

1. "Digital VLSI Design Lab Manual" for R22a BE(VLSI)

22EGC03

EMPLOYABILITY SKILLS

(BE / BTech - Common to all Branches)

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	01

Prerequisite: Basic Knowledge of Soft skills in the professional setting.

Course Objectives:

This course aims to:

1. Learn the art of communication, participate in group discussions and case studies with confidence and to make effective presentations.
2. With- resume packaging, preparing them to face interviews.
3. Build an impressive personality through effective time management, leadership qualities, self-confidence and assertiveness.
4. Understand professional etiquette and to make them learn academic ethics and value system.
5. To be competent in verbal aptitude.

Course Outcomes:

By the end of the course**,** the students will be able to:

1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
4. Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.

Course Articulation Matrix

PO /PSO CO	O1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	1	-	-	-	1	-	2	3	3	1	3
CO 2	-	-	-	-	-	-	-	1	-	2	-	1
CO 3	-	-	-	-	-	1	-	1	2	1	1	3
CO 4	-	1	1	-	-	1	-	2	3	3	1	3
CO 5	-	-	-	-	-	-	-	1	2	2	1	3

UNIT-I

Verbal Aptitude: Error Detection, Articles, Prepositions, Tenses, Concord and Transformation of Sentences - Jumbled Words / Sentences - Vocabulary, Synonyms, Antonyms, One Word Substitutes, Idioms and Phrases, Word / Sentence / Text Completion- Reading Comprehension.

UNIT-II

Group Discussion & Presentation Skills: Dynamics of Group Discussion - Case Studies - Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence.

Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language - Preparing an Effective PPT.

UNIT-III

Behavioural Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management.

Corporate Culture – Grooming and etiquette-Statement of Purpose (SOP).

UNIT-IV

Mini Project: Research-Hypothesis-Developing a Questionnaire-Data Collection-Analysis-General and Technical Report - Writing an Abstract –Technical Report Writing-Plagiarism-Project Seminar.

UNIT-V

Interview Skills: Cover Letter and Résumé writing – Structure and Presentation, Planning, Defining the Career Objective, Projecting ones Strengths and Skill-sets – Interviews: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Mock Interviews.

Text Books:

1. Leena Sen, "Communication Skills", Prentice-Hall of India, 2005.
2. Gulati and Sarvesh, "Corporate Soft Skills", New Delhi: Rupa and Co., 2006.
3. Edgar Thorpe and Showick Thorpe, "Objective English", 2nd edition, Pearson Education, 2007.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.

Suggested Reading:

1. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
2. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", 2018.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.
4. Shalini Verma, "Body Language - Your Success Mantra", S Chand, 2006.

22EVU01

Up-skill Certification Course - I

Instruction	-
Duration of SEE	-
SEE	-
CIE	25 Marks
Credits	0.5