UG-R22 Curriculum
With effective from 2022-23

Electronics and Communications Engineering

Scheme of Instruction and Syllabi of
B.E I to IV Semester of
Four Year Degree Course

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institute | Affiliated to Osmania University)
Accreditated by NBA & NAAC (A++)
Kokapet Village, Gandipet Mandal, Hyderabad -500075, Telanagana.
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SCHEME OF INSTRUCTION AND SYLLABI

OF

B.E. / B.TECH. I TO IV SEMESTERS

FOR

ELECTONICS AND COMMUNICATION ENGINEERING

(Inline with AICTE Model Curriculum with effect from AY 2022-23)

(R–22 Regulation)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

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

Kokapet Village, Gandipet Mandal, Hyderabad– 500 075. Telangana

E-Mail: principal@cbit.ac.in; Website: www.cbit.ac.in;

Phone Nos.: 040-24193276 / 277 / 279

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

INSTITUTE VISION AND MISSION

VISION

To be a centre of excellence in technical education and research.

MISSION

To address the emerging needs through quality technical education and advanced research.

DEPARTMENTVISION AND MISSION

VISION

To emerge as a vibrant model of excellence in education, research and innovation in Electronics and Communication Engineering.

MISSION

- To impart strong theoretical and practical knowledge of the state of art technologies to meet growing challenges in the industry
- To carry out the advanced and need based research in consultation with the renowned research and industrial organizations
- To create entrepreneurship environment including innovation, incubation and encourage to patent the work

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. Engage successfully in professional career and/or pursue higher education in Electronics and Communication and allied areas.
2. Pursue research, design and development of state-of-the art systems applying the knowledge of Electronics and Communication engineering
3. Begin start-ups and involve in entrepreneurship activities by adopting changing professional and societal needs.
4. Exhibit professional ethics and values with lifelong learning and work effectively as individuals/team members in multidisciplinary projects.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Ability to apply the acquired knowledge of core subjects in design and development of Communications/Signal processing/ VLSI/ Embedded systems.
2. Analyze and solve the complex Electronics and Communication engineering problems using state-of-art hardware and software tools
3. Develop innovative technologies for Entrepreneurship based on the research outcomes of Electronics and Communication engineering.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

(Inline with AICTE Model Curriculum with effect from AY 2022-23)

B.E. - ELECTRONICS & COMMUNICATION ENGINEERING

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	22MTC01	Calculus	3	1	0	3	40	60	4
2	22CYC01	Chemistry	3	0	0	3	40	60	3
3	22EEC01	Basic Electrical Engineering	2	1	0	3	40	60	3
4	22CSC01	Problem Solving And Programming	2	1	0	3	40	60	3
PRACTICAL									
5	22CYC02	Chemistry Lab	0	0	3	3	50	50	1.5
6	22MBC02	Community Engagement	0	0	3	3	50	0	1.5
7	22CSC02	Problem Solving and Programming Lab	0	0	3	3	50	50	1.5
8	22MEC37	Robotics & Drones Lab	0	2	2	3	100	0	3
9	22EEC02	Basic Electrical Engineering Lab	0	0	2	3	50	50	1
TOTAL			**10**	**5**	**13**				**21.5**

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - SEE**

22MTC01

CALCULUS
(ECE)

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

COURSE OBJECTIVES: This course aim is to
1. To explain the Partial Derivatives and the extreme values of functions of two variables.
2. To discuss Physical interpretations of scalar and vector functions.
3. To discuss vector line, surface and volume integrals.
4. To explain the concepts of basis, dimension of vector space and matrix representation of a linear transformation.
5. To explain the solution of system of linear equations by Matrix Methods.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Determine the extreme values of functions of two variables.
2. Apply the vector differential operator to scalar and vector functions
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Determine the basis and dimension of a vector space, compute linear transformation.
5. Apply the Matrix Methods to solve the system of linear equations

CO-PO ARTICULATION MATRIX

PO/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	-	-	-	-	-	-	-	1
CO 5	3	3	3	3	-	-	-	-	-	-	-	1

UNIT I

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 II

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 III

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 IV

Vector space: Vector space, Subspace, linear combination of vectors, linear span, row and column spaces, linear dependent, independent vectors, basis, dimension, linear transformation, invertible transformation, matrix of linear transformation, kernel and range of LT, rank and nullity of LT-rank nullity theorem(without proof), change of basis.

UNIT V

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", 5th Edition, McGraw Hill, 2013.
4. Gilbert Strang, "Introduction to linear algebra", 5th Edition, Wellesley - Cambridge press, 2016.

SUGGESTED READING:

1. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications, 5th edition, 2016.
3. D. Poole, "Linear Algebra: A Modern Introduction, 2nd Edition", Brooks/ Cole, 2005.
4. Kuldeep Singh, "Linear algebra: step by step". OUP Oxford, 2013.

22CYC01

CHEMISTRY
(ECE)

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

COURSE OBJECTIVES: This course aim is 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: After completion of this course, students will be able to

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.

CO-PO ARTICULATION MATRIX

PO/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	2	-	-	2	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	3	-	-	2	2	-	-	-	-	2
CO 5	3	2	2	-	-	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, and 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 READING:

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

COURSE OBJECTIVES: This course aim is 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 completion of this course, students 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.

CO-PO ARTICULATION MATRIX

PO/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, and 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

22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

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

COURSE OBJECTIVES: This course aim is to

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

COURSE OUTCOMES: After completion of this course, students will be able to

1. Understand various Python program development Environments.
2. Demonstrate the concepts of Python.
3. Implement algorithms/flowcharts using Python to solve real-world problems.
4. Build and manage dictionaries to manage data.
5. Write Python functions to facilitate code reuse.
6. Use Python to handle files and memory.

CO-PO ARTICULATION MATRIX

PO/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
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	2	3	3	2	3	-	-	-	-	-	-	1
CO4	2	3	3	2	2	-	-	-	-	-	-	1
CO5	2	3	3	3	3	-	-	-	-	-	-	1
CO6	2	3	3	3	3	-	-	-	-	-	-	1

LABORATORY / PRACTICAL EXPERIMENTS:

1. Explore various Python Program Development Environments.
2. Demonstration of input/output operations.
3. Demonstration of operators.
4. Demonstration of selective control structures.
5. Demonstration of looping control structures.
6. Demonstration of List, Tuple and Set
7. Demonstration of Python Dictionaries.
8. Implementation of searching and sorting techniques.
9. Implementation of string manipulation operations.
10. File handling and memory management operations.

TEXT BOOKS AND REFERENCES:

1. R.S. Salaria, “Programming for Problem Solving”, First Edition, Khanna Book Publishing Co., Delhi.
2. Jeeva Jose, “Taming Python by Programming”, Revised Edition, Khanna Book Publishing Co., Delhi.
3. Mark Lutz, “Learning Python”, 5th Edition, , O'Reilly Media, Inc.,
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.
5. “Programming in Python”, R.S. Salaria, Khanna Book Publishing Co., Delhi.

NPTEL/SWAYAM COURSES:

1. Introduction to Problem Solving and Programming, Video Lectures, Prof. D Gupta, IIT Delhi.
2. Problem Solving Aspects and Python Programming, Dr. S Malinga, Dr Thangarajan, Dr. S V Kogilavani, Kongu Engineering College.
3. https://www.coursera.org/specializations/python-3-programming.

22CYC02

CHEMISTRY LAB

Instruction:	3P Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
Continuous Internal Evaluation:	50 Marks
Credits:	1.5

COURSE OBJECTIVES: This course aim is 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 theorical 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.

CO-PO ARTICULATION MATRIX

PO/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 EXPERIMENTS:

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.

22MBC02

COMMUNITY ENGAGEMENT

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

COURSE OBJECTIVES: This course aim is 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 completion of this course, students 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.

Module I

Appreciation of Rural Society: Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II

Understanding Rural Economy and Livelihood: Agriculture, Farming, Landownership, Water management, Animal Husbandry, 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, Local Civil Society, Local Administration.

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, Gram Panchayat Decentralised Planning, 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).

22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

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

COURSE OBJECTIVES: This course aim is to
1. Master the fundamentals of writing Python scrips.
2. Learn Python elements such as variables, flow controls structures, and functions.
3. Discover how to work with lists and sequence data, and files.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Understand various Python program development Environments.
2. Demonstrate the concepts of Python.
3. Implement algorithms/flowcharts using Python to solve real-world problems.
4. Build and manage dictionaries to manage data.
5. Write Python functions to facilitate code reuse.
6. Use Python to handle files and memory.

CO-PO ARTICULATION MATRIX

PO/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
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	2	3	3	2	3	-	-	-	-	-	-	1
CO4	2	3	3	2	2	-	-	-	-	-	-	1
CO5	2	3	3	3	3	-	-	-	-	-	-	1
CO6	2	3	3	3	3	-	-	-	-	-	-	1

LABORATORY / PRACTICAL EXPERIMENTS:
11. Explore various Python Program Development Environments.
12. Demonstration of input/output operations.
13. Demonstration of operators.
14. Demonstration of selective control structures.
15. Demonstration of looping control structures.
16. Demonstration of List, Tuple and Set
17. Demonstration of Python Dictionaries.
18. Implementation of searching and sorting techniques.
19. Implementation of string manipulation operations.
20. File handling and memory management operations.

TEXT BOOKS AND REFERENCES:
1. R.S. Salaria, “Programming for Problem Solving”, First Edition, Khanna Book Publishing Co., Delhi.
2. Jeeva Jose, “Taming Python by Programming”, Revised Edition, Khanna Book Publishing Co., Delhi.
3. Mark Lutz, “Learning Python”, 5th Edition, , O'Reilly Media, Inc.,
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.
5. “Programming in Python”, R.S. Salaria, Khanna Book Publishing Co., Delhi.

NPTEL/SWAYAM Courses:
1. Introduction to Problem Solving and Programming, Video Lectures, Prof. D Gupta, IIT Delhi.
2. Problem Solving Aspects and Python Programming, Dr. S Malinga, Dr Thangarajan, Dr. S V Kogilavani, Kongu Engineering College.
3. https://www.coursera.org/specializations/python-3-programming.

22MEC37

ROBOTICS AND DRONES LAB

(Common to All Branches)

Instruction	2T + 2P Hours per week
CIE	100 Marks
Credits	3

COURSE OBJECTIVES: This course aim is to

1. To develop the students' knowledge in various robot and drone structures and their workspace.
2. To develop multidisciplinary robotics that have practical importance by participating in robotics competitions
3. To develop students' skills in performing spatial transformations associated with rigid body motions, kinematic and dynamitic analysis of robot systems.
4. Through projects done in lab, increase the true hands-on student learning experience and enhance their conceptual understanding, increase students' ability, competence and teamwork skills on dealing with real-life engineering problems

COURSE OUTCOMES: After completion of this course, students will be able to

1. Demonstrate knowledge of the relationship between mechanical structures of robotics and their operational workspace characteristics
2. Understand mechanical components, motors, sensors and electronic circuits of robots and build robots.
3. Demonstrate knowledge of robot controllers.
4. Use Linux environment for robotic programming.
5. Write Python scripts to control robots using Python and Open CV.

COURSE ARTICULATION MATRIX

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	2	1	1	1	2	2	2
CO2	2	3	1	2	3	1	1	1	1	2	2	1
CO3	2	2	2	2	2	1	1	1	1	2	2	2
CO4	2	2	1	2	2	2	1	1	1	2	2	2
CO5	1	1	1	1	1	3	3	3	1	3	3	3

LIST OF EXPERIMENTS:

1. Assembling of robot mechanical components, mounting of motors, sensors, electronic circuits to the chassis.
2. Connecting to electronic circuitry: motor drivers, incremental encoders proximity sensors, micro controller,
3. Different types of batteries, selection of suitable battery for application, safety precaution.
4. Introduction to Linux Command Line Interface: basic file and directory management and other useful commands
5. Controlling robot using Python: i) Move robot using Python code, ii) Make robot move in patterns using Python
6. Robot programming with Sensor inputs: i) Read sensor data using Python, ii) Visualize sensor data using Python, iii) Code robot to avoid obstacles by using sensor data
7. Open CV: i) Create an Image and display an image; ii) Read and change pixel values; iii) Create colored shapes and save image; iv) Extract the RGB values of a pixel; v) Reading and Writing Videos
8. Open CV: i) Extraction of Regions of Interest; ii) Extraction of RGB values of a pixel
9. Coding robot to work with colors, follow colored objects, identifying shape of the object-oriented
10. Projects: i)Making a line follower robot using a Camera; ii) Writing code for a complex function Assembly of a drone

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 SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

COURSE OBJECTIVES: This course aim is 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: After completion of this course, students will be able 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.

CO-PO ARTICULATION MATRIX

PO/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 improvem
7. ent of single-phase AC System.
8. Active and Reactive Power measurement of a single-phase system using

a. 3-Ammeter method b. 3-Voltmeter method

9. Measurement of 3-Phase Power in a balanced system
10. Calibration of single-phase energy meter.
11. Verification of Turns/voltage ratio of single-phase Transformer.
12. Open Circuit and Short Circuit tests on a given single phase Transformer.
13. Brake test on DC Shunt Motor
14. Speed control of DC Shunt Motor.
15. Demonstration of Measuring Instruments and Electrical Lab components.
16. Demonstration of Low-Tension Switchgear Equipment/Components.
17. 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 (A)

(Inline with AICTE Model Curriculum with effect from AY 2022-23)

B.E. - ELECTRONICS & COMMUNICATION ENGINEERING

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	0	3	40	60	4
2	22PYC06	Electromagnetic Theory and Quantum Mechanics	3	0	0	3	40	60	3
3	22CEC01	Engineering Mechanics	3	1	0	3	40	60	4
4	22EGC01	English	2	0	0	3	40	60	2
PRACTICAL									
5	22PYC09	Electromagnetic Theory and Quantum Mechanics Lab	0	0	3	3	50	50	1.5
6	22EGC02	English lab	0	0	2	3	50	50	1
7	22MEC01	CAD AND DRAFTING	0	1	3	3	50	50	2.5
8	22MEC38	Digital Fabrication Lab	0	0	3	3	50	50	1.5
TOTAL			**11**	**3**	**11**				**19.5**

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - SEE**

22MTC05

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS
(ECE)

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

COURSE OBJECTIVES: This course aim is 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: After completion of 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.

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	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", 44th Edition, Khanna Publishers, 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", 9th edition, Laxmi Publications, 2017.
2. R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th edition, Narosa Publications, 2016.

22PYC01

OPTICS AND SEMICONDUCTOR PHYSICS

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

COURSE OBJECTIVES: This course aim is to
1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

COURSE OUTCOMES: After completion of this course, students will be able to
1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

CO-PO ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	2	2	2	1	1	2	1	2
CO2	3	3	3	3	3	3	3	3	2	2	3	2
CO3	3	3	3	3	3	2	3	2	1	2	1	2
CO4	2	2	2	1	2	2	2	2	1	2	2	2
CO5	3	2	2	2	2	2	3	3	2	2	3	2

UNIT I

Wave Optics: Huygen's principle –Super position of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings– Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser – Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction– Applications.

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 –Fiberlosses--Fiber optic communication system –Applications.

UNIT III

Principles of 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 –Scattering from potential step – Potential barrier and tunneling.

UNIT IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT V

Semiconductors: Intrinsic and extrinsic semiconductors – Charge carrier concentration in intrinsic semiconductors – Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) – 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.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, Mc Graw-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.

22CEC01

ENGINEERING MECHANICS

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

COURSE OBJECTIVES: This course aim is to

1. Understand the resolution of forces and to obtain resultant of all force systems,
2. Understand equilibrium conditions of static loads for smooth and frictional surface
3. Analyse simple trusses for forces in various members of a truss
4. Obtain centroid, centre of gravity for various regular and composite areas and bodies
5. Obtain Moment of inertia for various regular and composite areas and bodies and also to obtain Mass moments of inertia of elementary bodies

COURSE OUTCOMES: After completion of this course, students will be able to

1. Calculate the components and resultant of coplanar forces system and Draw free body diagrams to analyze the forces in the given structure
2. Understand the mechanism of friction and can solve friction problems
3. Analyse simple trusses for forces in various members of a truss.
4. Determine the centroid of plane areas, composite areas and centres of gravity of bodies.
5. Determine moments of inertia, product of inertia of plane and composite areas and mass moments of inertia of elementary bodies,

CO-PO ARTICULATION MATRIX

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

UNIT I

Resolution and Resultant of Force System: Basic concepts of a force system. Components of forces in a plane. Resultant of coplanar concurrent force system. Moment of a force, couple and their applications. Resultant of coplanar non-concurrent force system

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of coplanar force systems.

UNIT II

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge and belt friction

UNIT III

Analysis of Simple Trusses: Introduction to trusses, Assumptions, analysis of simple trusses using method of joints and method of sections.

UNIT IV

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappus & its applications. Center of gravity of elementary and composite bodies

UNIT V

Moment of Inertia: Definition of MI, Area MI. Polar Moment of Inertia, radius of gyration, transfer theorem, Moment of Inertia of elementary & composite areas, and Product of inertia. Mass moments of inertia of elementary bodies.

TEXT BOOKS:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer's Engineering Mechanics, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and Collins, Singapore, 1904.

SUGGESTED READING:

1. A. Nelson, Engineering Mechanics, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, Applied Mechanics**,** Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
5. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010

22EGC01

ENGLISH

Instruction	2 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

PREREQUISITE: Basic knowledge of English grammar and vocabulary.

COURSE OBJECTIVES: This course aim is to
1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal Emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques.

CO-PO-PSO ARTICULATION MATRIX

PO/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	2	2	1	2
CO 3	-	2	1	1	-	2	1	1	2	2	1	2
CO 4	1	2	1	2	1	2	2	1	2	2	1	2
CO 5	1	2	1	2	1	1	1	1	1	2	1	2

UNIT I

Understanding Communication in English: Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.

Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT II

Developing Writing Skills I: Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT III

Developing Writing Skills II: Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response.

Vocabulary and Grammar: Subject-verb agreement. Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT IV

Developing Writing Skills III: Report writing – Importance, structure, elements of style of formal reports; Writing a formal report.

Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT V

Developing Reading Skills: The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar: Words often Confused; Use of standard abbreviations.

TEXT BOOKS:

1. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.
2. Swan Michael, "Practical English Usage", OUP, 1995.

SUGGESTED READING:

1. Wood F.T, "Remedial English Grammar", Macmillan, 2007.
2. Zinsser William, "On Writing Well", Harper Resource Book, 2001.
3. Sanjay Kumar and Pushp Lata, "Communication Skills", Oxford University Press, 2011.

22PYC09

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS LAB (ECE & EEE)

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

COURSE OBJECTIVES: This course aim is to

1. Apply the concepts of physics while doing experiments
2. Understand the nature of the light experimentally
3. Analyzethebehaviourofsemiconductormaterialsandoptoelectronicdevices

COURSE OUTCOMES: After completion of this course, students 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

CO-PO ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	1	3	1	3	3	2	1	2
CO2	3	2	1	2	2	2	1	2	2	1	1	3
CO3	3	2	3	2	3	1	2	2	3	2	1	2
CO4	3	3	2	2	2	1	2	3	2	1	1	3
CO5	3	1	2	3	2	1	1	2	2	2	1	2

LIST OF 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.

22EGC02

ENGLISH LAB

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

PREREQUISITE: Basic Knowledge of English Communication.

COURSE OBJECTIVES: This course aim is to

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to discuss in groups and making oral presentations.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

CO-PO-PSO ARTICULATION MATRIX

PO/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
CO 2	-	-	-	-	-	1	-	1	2	2	1	2
CO 3	-	-	-	-	-	1	1	1	2	1	1	2
CO 4	1	-	-	-	-	1	2	2	2	3	1	3
CO 5	1	1	1	1	1	2	2	2	3	3	2	3

LIST OF EXERCISES:

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to International Phonetic Alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material.
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given.
10. **Poster presentation –** Theme, poster preparation, team work and e presentation.

SUGGESTED READING:

1. T Balasubramanian, “A Textbook of English Phonetics for Indian Students”, Macmillan, 2008.
2. J Sethi et al., “A Practical Course in English Pronunciation (with CD)”, Prentice Hall India, 2005.
3. Priyadarshi Patnaik, “Group Discussions and Interviews”, Cambridge University Press Pvt. Ltd., 2011.
4. Aruna Koneru, “Professional Speaking Skills”, Oxford University Press, 2016.

22MEC01

CAD AND DRAFTING

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

COURSE OBJECTIVES: This course aim is to

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

COURSE OUTCOMES: After completion of this course, students will be able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

CO-PO ARTICULATION MATRIX

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	2	-	1	2	3	1	3
CO2	3	2	2	1	2	2	-	1	2	2	1	2
CO3	3	3	2	1	2	2	-	1	2	2	1	2
CO4	3	3	3	2	2	2	-	1	2	2	1	2
CO5	3	2	2	1	2	2	-	1	2	2	1	2

LIST OF EXERCISES:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
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
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. 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.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

22MEC38

DIGITAL FABRICATION LAB

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

COURSE OBJECTIVES: The objectives of this course are to:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization positive &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, welding, casting, manufacturing, metrology, and allied skills.
5. Advance important hard & 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: After completion of course, students would 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.

CO-PO-PSO Correlation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	1
CO2	1	-	-	-	1	-	-	-	-	-	-	2
CO3	2	1	1	1	3	-	1	-	-	-	-	2
CO4	2	2	2	1	3	-	-	-	-	-	-	2
CO5	3	2	1	-	3	-	-	-	-	-	-	2

List of exercises:

Group-1

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dove tail-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 three pin socket controlled by a single pole switch
    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 three pin socket
4. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.
5. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings & bends.
6.
    a. A. To connect the GI pipes as per the given diagram using, couplings, unions, reducer & bends.
    b. To connect the GI pipes as per the given diagram using shower, tap & valves and Demonstrate by giving water connection

Group- 2

1. To Study the method of Additive Manufacturing process using a 3D printer
2. To create a 3D CAD model of a door bracket using a modeling software
3. To Print a door bracket using an extruder type 3D Printer.
4. To create a 3D CAD model by reverse Engineering
5. To Design an innovative component using the CAD software
6. To Print the selected innovative component by the students 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.
3. Sachidanand Jha, 3D PRINTING PROJECTS: 200 3D Practice Drawings For 3D Printing On Your 3D Printer, June 7, 2019.

SUGGESTED READING:

1. Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Oliver Bothmann , 3D Printers: A Beginner's Guide , January 1, 2015

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

(Inline with AICTE Model Curriculum with effect from AY 2023-24)

BE (Electronics and Communication Engineering)

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	22MTC08	Transform Theory and Complex Analysis	3	-	-	3	40	60	3
2	22CSC29	C and Data Structures	3	-	-	3	40	60	3
3	22ECC01	Electronic Devices	3	-	-	3	40	60	3
4	22ECC02	EM Waves and Transmission Lines	3	-	-	3	40	60	3
5	22ECC03	Network Analysis and Synthesis	3	-	-	3	40	60	3
6	22ECC04	Signals and Systems	3	-	-	3	40	60	3
PRACTICALS									
7	22CSC30	C and Data Structures Lab	-	-	2	3	50	50	1
8	22ECC05	Electronic Devices Lab	-	-	2	3	50	50	1
9	22ECC06	Network Analysis and Synthesis Lab	-	-	2	3	50	50	1
10	22ECI01	MOOCs / Training / Internship	3-4 weeks / 90 hours				50	-	2
Total			**18**	**-**	**6**	**27**	**440**	**510**	**23**
Clock Hours Per Week: 24									

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

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: SEE**

22MTC08

TRANSFORM THEORY AND COMPLEX ANALYSIS
(ECE)

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

Prerequisites: The Student should be familiar about elementary Calculus and Complex variables.

COURSE OBJECTIVES: The objectives of this course are to:

1. To learn the Laplace, Z- Transform concepts.
2. To solve linear and Non-Linear partial differential equations.
3. To learn concepts of analytic functions and complex integration.

COURSE OUTCOMES: On successful completion of this course the students shall be able to

1. Find Laplace, Inverse Laplace and solution of engineering problems.
2. Find the solution of Difference Equation.
3. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
4. Solve the problems on analytic functions, Cauchy's theorem and Cauchy's integral formula.
5. Complex integrals by using Cauchy's Residues theorem.

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	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**
CO 2	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**
CO 3	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**
CO 4	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**
CO 5	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**

UNIT I: **Laplace Transforms**

Laplace Transform of Elementary functions, Linearity property, First Shifting property, Change of scale property. Laplace Transform of Periodic functions, Transforms of derivatives, integral's, Multiplication by t and division by t. Evaluation of Integrals by Laplace Transforms. Inverse Laplace transforms of elementary functions, Inverse Laplace Transform by Method of partial fractions and Convolution theorem, Solution of Ordinary Differential Equations by Laplace Transform method.

UNIT II: Z-Transforms

Z-transforms of standard functions, linearity property, damping rule, shifting theorems, multiplication by 'n', Initial value theorem. Inverse Z-transforms of standard functions, Inverse Z-transform by Convolution theorem and partial fractions method. Z-transform application to difference equations.

UNIT III Partial Differential Equations

Linear Equations of First Order (Lagrange's Linear Equations), Solution of First Order Non-linear Partial Differential Equations (Standard forms) and Charpit's Method. Solutions by method of separation of variables, solution of One dimensional wave equation and its applications.

UNIT IV Function of Complex Variables

Limit continuity and derivative of complex function, Analytic functions ,CR equations ,Harmonic functions , Conjugate harmonic function, Complex integration, Cauchy's theorem (without Proof), Cauchy-integral formula (without proof).

UNIT V Series of Complex terms:

Taylor's Series, Laurent's Series, Types of Singularities, Residues, Cauchy's Residue theorem (without proof), Calculation of Residues.

Series Solution: Bessel's Equations, Recurrence relations, Expansions of J_0, J_1, $J_{1/2}$, $J_{-1/2}$

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.
2. Sharma J.N, "Functions of a Complex variables", Krishna Prakashan Media, 49th Edition.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

SUGGESTED READING:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2008.
3. James ward Brown, Ruel V. Churchill", Complex variables an Applications", McGraw Hill Higher Education, 2013.

22CSC29

C AND DATA STRUCTURES
(Common for ECE and EEE)

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

Prerequisite: Problem Solving and Programming.

Course Objectives: This course aims to:
1. To discuss the concepts of Functions, Arrays, Pointers and Structures.
2. To familiarize with Stack, Queue and Linked lists data structures.
3. To explain the concepts of non-linear data structures like graphs and trees.

COURSE OUTCOMES: Upon completion of this course, students will be able to:
1. Analyze the basic concepts of C Programming language.
2. Design applications in C, using functions, arrays, pointers and structures.
3. Apply the concepts of Stacks and Queues in solving the problems.
4. Explore various operations on Linked lists.
5. Demonstrate various tree traversals and graph traversal techniques.

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	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	1	1	1	1	1	1	1	1	1	1	1
CO 2	3	3	3	1	1	1	1	1	1	1	1	1	1	2	1
CO 3	3	3	3	1	1	2	1	1	1	1	1	1	1	2	1
CO 4	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1
CO 5	3	3	3	1	1	1	1	1	1	1	1	1	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, File Operations.

UNIT - III

Data Structures: Overview of data structures, Types of Data Structures.
Stacks: Introduction, Operations on Stack, implementation of stack, Applications of Stacks- infix, prefix, and postfix notations, infix to postfix conversion, evaluation of arithmetic expressions, evaluation of postfix expression, recursion.
Queues: Introduction, Operations-representation of queue, insertion, deletion, searching operations, Applications of queues.

UNIT - IV

Linked Lists: Introduction, Types of linked list-Single linked list, Double linked lists, Circular linked lists, dynamic linked stacks and queues. Operations on all types of linked lists.
Application of Linked Lists: Polynomial representation.

UNIT - V

Trees: Tree terminology, representation, types of trees, Binary trees, representation, tree traversals, binary search tree and its operations.

Graphs: Graph terminology, representation, elementary graph operations, Graph traversals-Breadth First Search (BFS) and Depth First Search (DFS), spanning trees.

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition, 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.

SUGGESTED READING:

1. M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009Pearson, 2013.
2. Kamala Krithivasan, Rama R. "Introduction to Automata Theory, and Computation", Pearson 2009.

NPTEL/SWAYAM Course:

1. Programming and Data Structure,IIT Kharagpur Dr.P.P.Chakraborty -https://nptel.ac.in/courses/106105085
2. Programming, Data Structures and Algorithms using C - https://archive.nptel.ac.in/courses/106/106/106106127/

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.

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	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 2	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 3	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 4	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 5	1	3	1	2	2	1	1	2	1	1	1	2	3	3	1

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.

22ECC02

EM WAVES AND TRANSMISSION LINES

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

Prerequisite: Students should have prior knowledge about coordinate systems, vector calculus, Electrostatics and Steady Magnetic Fields.

Course Objectives: This course aims to:
1. Provide the concepts of boundary conditions.
2. Understand the Maxwell's equations and conceptualize the wave propagation characteristics in different mediums.
3. Provide the concepts of transmission lines.

COURSE OUTCOMES: Upon completion of this course, students will be able to:
1. Comprehend the boundary conditions, time varying fields and understand Maxwell's equations in different forms.
2. Illustrate the Electromagnetic wave properties with respect to different transmission mediums and predict the behavior of reflection and refraction of the waves in different mediums.
3. Understand the concepts of transmission lines and the significance of Open and Short circuit Lines.
4. Estimate the transmission line properties, reflection, and matching concepts.
5. Conceptualizing Microwaves and analyzing the waves in the waveguides.

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	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	2	1	3	1	1	2	1	1	2	3	3	3
CO 2	2	3	2	1	1	3	2	1	2	1	1	2	3	3	3
CO 3	2	2	1	3	1	3	1	2	3	1	1	2	3	3	3
CO 4	2	2	1	3	1	3	1	2	1	1	1	2	3	3	3
CO 5	2	2	1	2	1	3	1	1	3	1	1	2	3	3	3

UNIT - I

Time varying fields: Review of coordinate systems, Boundary conditions: Boundary conditions on Electric and Magnetic fields across a conductor interface and across two mediums. Time varying fields, Faradays Law, Modified Amperes Law, Gauss Law for Electric and Magnetic Fields, Maxwell equations: Integral form and Point form.

UNIT - II

Electromagnetic Waves: Wave equations, Uniform plane waves in lossy and lossless medium, Skin Depth, Polarization, Instantaneous and Average Poynting theorem and its applications, Reflection and Refraction of Plane Waves - Normal and Oblique Incidence for perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection.

UNIT - III

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Impedance at any point on the transmission line. RF and UHF Lines, Open and Short circuit lines and their significance, Properties of $\lambda/2$, $\lambda/4$ and $\lambda/8$ Lines.

UNIT - IV

Transmission Lines - II: Distortion and distortion less transmission line, Concept of loading of a transmission line, Campbell's formula, Reflection and VSWR, Matching- Quarter wave transformer, Single Stub matching, Smith chart and its applications.

UNIT - V

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves. Rectangular Waveguides: TE and TM waves, Impossibility of TEM wave in waveguides.

TEXT BOOKS:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics" 6th edition, 2015, Newyork Oxford University Press.
2. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition., 2000, PHI.
3. Samuel Y. Liao, "Microwave Devices and Circuits," 3/e, Pearson Education, 2003.

SUGGESTED READING:

1. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 8th edition, 2016, TMH
2. John D. Ryder, "Networks Lines and Fields", 2nd edition, 2015, PHI.
3. R.K. Shevgaonkar, "Electromagnetics Waves", Tata McGraw Hill India, 2005.
4. Sunil Bhooshan, "Fundamentals of Engineering Electromagnetics", 2012, Oxford University Press Publication.

22ECC03

NETWORK ANALYSIS AND SYNTHESIS

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

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 magnetic coupled 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 coupled circuits, Filters.
5. Synthesize different network functions using Foster and Cauver form.

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	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 2	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 3	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 4	3	3	2	2	1	1	1	1	2	3	1	3	3	2	3
CO 5	3	3	3	2	1	1	1	1	2	3	1	3	3	2	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 simple circuits.

UNIT - IV

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

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

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.

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	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 2	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 3	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 4	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1
CO 5	3	2	1	1	1	1	1	1	1	2	1	2	2	1	1

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.

22CSC30

C AND DATA STRUCTURES LAB
(Common for ECE and EEE)

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

Prerequisite: Problem Solving and Programming.

Course Objectives:
This course aims to:
1. Master the concepts of Functions, Arrays, Pointers and Structures.
2. Learn data structures such as Stack, Queue and Linked lists.
3. Write C programs to implement Trees and Graphs.

COURSE OUTCOMES:
Upon completion of this course, students will be able to:
1. Understand and trace the execution of programs written in C language.
2. Apply the concepts of looping and decision-making statements for a given problem.
3. Solve problems using functions, arrays , structures and pointers.
4. Implementation various operations on stack , queue, tree and graph.
5. Apply the knowledge of data structure in problem solving.

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	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	1	1	1	1	1	1	1	1	1	1	1	1
CO 2	3	3	3	1	1	1	1	1	1	1	1	1	1	2	1
CO 3	3	3	3	1	1	1	1	1	1	1	1	1	1	2	1
CO 4	2	3	3	1	1	1	1	1	1	1	1	1	1	1	1
CO 5	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1

Laboratory / Practical Experiments:
1. Using if and Switch Constructs Programs.
2. Demonstration of Looping Statements Problems.
3. Demonstration of Functions and Recursive Programs.
4. Demonstration of Structures and Union Programs.
5. Demonstration of Command line arguments.
6. Demonstration of Pointers and Arrays Programs.
7. Implementation of Stacks and Queues.
8. Implementation of Linked List Programs: Single , Double and Circular Linked List.
9. Implementation of Trees: Tree operations and its traversals.
10. Implementation of Graph traversals- DFS and BFS.

TEXT BOOKS:
1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition, 2011.
2. E. Balaguruswamy, “C and Data Structures”, 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.

SUGGESTED READING:
1. M.T. Somashekara, “Problem Solving Using C”, PHI, 2nd Edition 2009Pearson, 2013.
2. Kamala Krithivasan, Rama R. “Introduction to Automata Theory, and Computation”, Pearson 2009.

NPTEL/SWAYAM Course:
1. Programming and Data Structure,IIT Kharagpur Dr.P.P.Chakraborty - https://nptel.ac.in/courses/106105085
2. Programming, Data Structures and Algorithms using C - https://archive.nptel.ac.in/courses/106/106/106106127/

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.

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	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 2	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 3	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 4	2	2	1	1	2	1	1	2	2	2	2	2	3	3	2
CO 5	2	2	1	1	2	1	1	2	2	2	2	2	3	3	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.

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.

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	PSO 1	PSO 2	PSO 3
CO 1	1	1	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	1	3	2
CO 3	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 4	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
CO 5	1	1	1	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, RL Circuits.
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.

22ECI01

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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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	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	3	3	1	3	1	3	3	1	1	3
CO 2	1	1	1	3	3	1	2	1	1	1	1	1	3	3	1
CO 3	2	3	3	3	3	2	3	1	1	1	1	1	3	3	1
CO 4	1	1	1	1	1	3	1	1	3	3	1	1	1	1	3
CO 5	1	3	3	3	3	2	3	1	1	1	1	1	3	3	3

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 (A)

(Inline with AICTE Model Curriculum with effect from the AY 2023-24)

BE (Electronics and Communication Engineering)

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	22ECC07	Analog Circuits	3	-	-	3	40	60	3
2	22ECC08	Antennas and Wave Propagation	3	-	-	3	40	60	3
3	22ECC09	Control Systems	3	-	-	3	40	60	3
4	22ECC10	Digital System 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	22ECC12	Analog Circuits Lab	-	-	2	3	50	50	1
9	22ECC13	Digital System Design Lab	-	-	2	3	50	50	1
10	22ECC14	Modelling and Simulation Lab	-	-	2	3	50	50	1
11	22EGC03	Employability Skills	-	-	2	3	50	50	1
Total			**17**	**1**	**8**	**29**	**450**	**550**	**20**
Clock Hours Per Week: 26									

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

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: SEE**

22ECC07

ANALOG CIRCUITS

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

Prerequisite: Student should have knowledge of Electronic Devices.

Course Objectives: This course aims to:
1. The various biasing circuits for BJT and FET.
2. The analysis of BJT & FET in various configurations using small signal equivalent models.
3. The concepts of multistage, feedback amplifiers, and power amplifier.

COURSE OUTCOMES: Upon completion of this course, students will be able to:
1. Apply the knowledge of BJT behavior in the design of various biasing and amplifier circuits.
2. Relate the knowledge of FET characteristics in the design of various biasing and amplifier circuits.
3. Apply high and low frequency models of transistor in the analysis of single stage and multistage amplifiers.
4. Analyze negative feedback amplifier circuits and compare them.
5. Compare and Contrast different types of Oscillators and Power amplifiers.

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	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	3	1	1	1	1	1	1	1	1	3	2	1
CO 2	3	3	3	2	1	1	1	1	1	1	1	1	3	2	1
CO 3	3	3	3	3	1	1	1	1	1	1	1	1	3	2	1
CO 4	3	3	3	2	1	1	1	1	1	1	1	1	3	2	1
CO 5	3	2	1	2	1	1	1	1	1	1	1	1	3	2	1

UNIT - I

BJT Biasing: Operating point, Bias stability, stability factors, BJT biasing techniques: Fixed Bias, Collector-Base bias, Emitter Bias, Voltage-Divider bias, Thermal runaway.

BJT Amplifiers: CB, CE and CC amplifiers: Analysis using h-parameters ((approximate and exact analysis), Comparison of the three amplifier configurations, Millers Theorem – application circuit, Frequency response of BJT amplifiers.

UNIT - II

JFET biasing: Fixed biasing, Self-bias and Voltage-divider bias configurations, FET biasing for zero current drift.

JFET Amplifiers: CS, CD and CG amplifiers: Analysis using small-signal model, Comparison of three amplifier configurations, Frequency response of FET Amplifiers.

UNIT - III

Multistage amplifiers: Overview of Coupling schemes - RC coupling, Transformer coupling and Direct coupling; Analysis of CE-CE, CE-CB, CC-CC Darlington pair, Multi-stage frequency effects.

Transistor at high frequencies: Hybrid π CE transistor model, Hybrid π Conductances and Capacitances, CE short circuit current gain.-

UNIT IV

Negative Feed Back Amplifiers: The feedback concept, General characteristics of negative feedback amplifiers, Effect of negative feedback on input and output impedances, Method of analysis of feedback amplifiers, Analysis of practical feedback circuits - 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, LC oscillators – Hartley and Colpitts Oscillators, Crystal oscillator.

Large Signal 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. Introduction to Tuned Amplifiers

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. Millman and Halkias, "Electronic Devices and Circuits" 2nd Edition, McGraw Hill Publication, 2007.
3. Donald Schilling, Charles Belove, Tuvia Apelewicz Raymond Saccardi, "Electronic Circuits: Discrete and Integrated", TMH, 3rd Edition, 2012.

22ECC08

ANTENNAS AND WAVE PROPAGATION

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

Prerequisite: Students should have prior knowledge about Electromagnetic waves.

Course Objectives: This course aims to:
1. Provide the basic principles of an antenna and its parameters for characterizing its performance.
2. Understand the fundamental concepts of various types of antennas and arrays for customizing the radiation pattern.
3. Understand the propagation behaviour of the radio waves.

COURSE OUTCOMES: Upon completion of this course, students will be able to:
1. Understand the basic parameters of an antenna.
2. Understand the radiation properties of antenna and analyze different type of wire antennas.
3. Analyze the linear arrays for uniform and non-uniform distribution.
4. Learn the concept of different types of planar antenna.
5. Study the behaviour of radio waves in various mode of wave propagation.

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	PSO 1	PSO 2	PSO 3
CO 1	2	3	3	1	1	2	3	1	3	1	1	2	3	3	3
CO 2	2	3	2	2	3	1	1	1	3	3	1	3	3	3	3
CO 3	3	3	2	2	3	1	2	1	3	3	3	3	3	3	3
CO 4	3	3	2	2	3	1	2	1	3	3	3	3	3	3	3
CO 5	3	3	2	2	3	1	2	1	3	3	3	3	3	3	3

UNIT - I

Antenna Basics: Principles of radiation, Retarded potential, Isotropic, Directional and Omni-directional radiators. Basic Antenna Parameters: Radiation patterns, radiation intensity, region separation, gain and directivity, Antenna polarization, Effective aperture and efficiency, Friis Transmission equation, Point sources and current distribution.

UNIT - II

Antenna Analysis: Analysis of Infinitesimal dipole, Half wave dipole, Loop antenna, Calculation of radiation resistance and directivity.

UNIT - III

Antenna Arrays: Uniform and Non-Uniform Arrays: Concept of Antenna Array, N-Element Uniform array, Two element array of Infinitesimal dipoles. Broadside and End fire arrays, Calculation of Directivity. Qualitative treatment of Non-Uniform array: Binomial and Tschebyscheff distribution and Qualitative treatment of Phased antenna array.

UNIT - IV

Microstrip Antennas: Radiation mechanism, different types, advantages and disadvantages. Design of rectangular Microstrip antenna. Reflectors: Paraboloidal Reflectors, Qualitative treatment of Smart Antennas.
Antenna Measurements: Measurement of Radiation Pattern and Gain.

UNIT - V

Wave Propagation: Frequency Spectrum, Ground wave propagation, Space and Surface waves, Tropospheric refraction and reflection, Duct propagation. Sky wave propagation: Critical frequency, Maximum Usable Frequency (MUF), Ionospheric Delay and Skip distance, Line of sight propagation.

TEXT BOOKS:

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", 4th Edition, John Wiley, 2016.
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2001.

SUGGESTED READING:

1. John D. Krauss, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 4th Edition, TMH, 2010.
2. Dennis Roody and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.
3. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

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.

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	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	1	1	1	1	1	1	1	1	1	3	2	2
CO 2	3	3	1	2	1	1	1	1	1	1	1	1	3	2	2
CO 3	3	3	3	3	2	1	1	1	1	1	1	1	3	2	2
CO 4	3	3	2	3	2	1	1	1	1	1	1	1	3	2	2
CO 5	3	3	3	2	1	1	1	1	1	1	1	1	3	2	2

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.

22ECC10

DIGITAL SYSTEM DESIGN

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 techniques for logic minimization.
2. Comprehend the concepts of various combinational circuits and sequential circuits.
3. Learn the Language fundamentals of Verilog HDL and also able to simulate and synthesize various digital modules.

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

1. Understand the basic concepts related to digital system design.
2. Design the combinational and sequential circuits.
3. Analyze the behavior of the digital system design.
4. Develop the digital system using various Verilog HDL modeling.
5. Apply the design concepts of digital system using Verilog HDL.

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	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	3	2	1	1	1	1	1	1	1	3	2	2
CO 2	3	2	2	3	2	1	1	1	1	1	1	1	3	3	2
CO 3	3	3	3	3	2	1	1	1	1	1	1	2	3	2	2
CO 4	3	3	3	3	2	2	1	2	2	1	1	2	3	2	3
CO 5	3	3	3	3	2	2	1	2	2	1	1	2	3	2	2

UNIT - I

Logic Simplification and Combinational Logic Design: Number system representation and conversion, Binary Arithmetic, Complements, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine –McCluskey Tabular Minimization Method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT - II

Introduction to Combinational 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 - III

Sequential Logic Design: Latches, Flipflops, Difference between latch and flipflop, types of flipflops like S-R, D, T, JK and Master-Slave JK Flip Flop, Flip flop conversions, setup and hold times, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts.

UNIT - IV

Introduction to HDLs: VLSI Design flow, Basic Concepts of Verilog HDL, Data Types, System Tasks and Compiler Directives. Gate Level Modelling: Gate Types and Gate Delays. Dataflow Modelling: Continuous Assignment and Delays. Design of Stimulus Block.

UNIT - V

Behavioral Modelling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modelling, Introduction to tasks and functions, Useful modelling Techniques, Procedural continuous assignments, Overriding parameters, Conditional compilation and execution, Introduction to Logic Synthesis. Concept of Programming using FPGA.

TEXT BOOKS:

1. Morris Mano M. and Michael D.Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th Edition, Pearson 2013.
2. Samir Palnitkar, "Verilog HDL, A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2008.

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.

22ECC11

PROBABILITY THEORY AND STOCHASTIC PROCESS

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.

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	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 2	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 3	1	2	1	1	1	1	1	2	1	1	1	2	3	3	1
CO 4	2	3	1	3	2	1	1	2	1	1	1	2	3	3	1
CO 5	1	3	1	2	2	1	1	2	1	1	1	2	3	3	1

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.

Code: 22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

(**B.E/B. Tech** - Common to all Branches)

Instruction	1Tutorial Hour per Week
CIE	50Marks
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.

COURSE OBJECTIVES: this cours 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: By the end of the course, STUDENT 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.

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

Reference Books:

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

Mapping of **Course Outcomes** with **Program Outcomes** and **Program Specific Outcomes**

PO/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**	-	-	**1**	-	-	**1**	1	1	1
CO 2	-	-	**1**	-	-	**1**	**1**	-	**1**	-	**1**	**1**	1	1	1
CO 3	--	-	-	-	-	**1**	-	-	-	**1**	-	-	1	1	2
CO 4	-	-	-	-	-	**1**	**1**	**1**	-	-	-	-	2	2	2
CO 5	-	-	-	-	-	**1**	**1**	**1**	-	-	-	-	2	2	2

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: Knowledge of Social Studies

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: Upon completion of this course, 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.

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	PSO 1	PSO 2	PSO 3
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. Indian Government & Politics, Ed Prof V Ravindra Sastry, 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.

22ECC12

ANALOG CIRCUITS LAB

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

Prerequisite: Knowledge on Electronic Devices Lab and Electronic Workshop and Networks Lab.

Course objectives: This course aims to familiarize:
1. Design and analysis of Biasing circuits and Single stage amplifiers.
2. The frequency response of Multistage and Feedback amplifiers.
3. The generation of sinusoidal signals using Oscillators.

COURSE OUTCOMES: Upon completion of this course, students will be able to:
1. Design various BJT and FET biasing circuits to identify the appropriate circuit for faithful amplification.
2. Experiment with single stage and multistage BJT/FET amplifiers to compare the Gain and Bandwidth.
3. Compare and contrast different types of feedback topologies.
4. Develop and test various oscillator circuits.
5. Evaluate the performance of large signal amplifiers.

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	PSO 1	PSO 2	PSO 3
CO 1	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1
CO 2	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1
CO 3	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1
CO 4	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1
CO 5	2	1	3	2	2	1	1	1	2	1	1	1	3	2	1

List of Experiments:
1. Design of BJT and FET Biasing Circuits for given specifications.
2. Common Emitter BJT amplifier and study of its frequency response.
3. Common Source FET amplifier and study of its frequency response
4. Frequency response of Two RC - Coupled CS FET amplifier
5. Voltage series feedback amplifier.
6. Voltage shunt feedback amplifier.
7. Current series feedback amplifier.
8. RC Phase Shift Oscillator.
9. Hartley Oscillator.
10. Colpitts Oscillator.
11. Class-A power amplifier.
12. Class-B power amplifier.
13. **Structured enquiry:** Design a circuit that converts a given D.C Voltage to Frequency using BJTs and verify its operation.
14. **Open ended Enquiry:** Design and implement a classroom sound monitoring system using BJTs and a 0.5W speaker.
15. **Virtual lab experiment:** Study of CE Amplifier (https://be-iitkgp.vlabs.ac.in/exp/ce-amplifier/)

Note: Wherever possible, Analysis and design of circuits should be carried out using SPICE tools.

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.

22ECC13

DIGITAL SYSTEM DESIGN LAB

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

Prerequisite: Digital concepts and C language concepts.

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. Simulate and synthesize combinational logic circuits.
5. Simulate and synthesize sequential logic circuits.

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	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	3	1	1	1	3	2	1	1	2	3	3
CO 2	3	2	2	2	3	1	1	1	3	2	1	1	2	3	3
CO 3	3	3	2	2	3	2	2	1	3	2	2	2	2	3	3
CO 4	3	3	2	3	3	2	2	2	3	2	2	2	3	3	3
CO 5	3	3	2	3	3	2	2	2	3	2	2	2	3	3	3

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.
3. Binary Subtractors.
4. Multiplexers and De-multiplexers.
5. Encoders, Decoders and Comparator.
6. Implementation of logic function using Multiplexers and Decoders.
7. Arithmetic and Logic Unit.
8. Flip-Flops:SR,D,T,JK.
9. Implementation of SSI Circuits using FPGA.
10. **Structured Enquiry:** Design of a counter for the given specifications.
11. **Open ended Enquiry:** Design of a simple Digital System for real time applications.

12. Virtual Lab Experiments: Verify 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.**

22ECC14

MODELLING AND SIMULATION LAB

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

Prerequisite: Knowledge of Signals and Systems, Control Systems.

Course Objectives: This course aims to:

1. To understand the simulation of generation of Various (Continuous/Discrete) signals.
2. To study various arithmetic operations on signals and various transforms applied for signals.
3. To understand the characteristics of control system and its characteristics.

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

1. Simulate the given waveform using standard test signals and sequences in MATLAB.
2. Analyze the effect of various transformations applied on signals in MATLAB.
3. Understand the second order system characteristics in LabView.
4. Simulate the Bode plot and Nyquist plot of the system and analysis its performance characteristics in LabView.
5. Understand the fundamentals of electronic circuits using Multisim simulation.

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	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	3	1	1	1	1	1	1	1	3	2	1
CO 2	3	3	2	1	3	1	1	1	1	1	1	1	3	2	1
CO 3	3	3	2	1	3	1	1	1	1	1	1	1	3	2	1
CO 4	3	3	2	1	3	1	1	1	1	1	1	1	3	2	1
CO 5	3	3	1	1	3	1	1	1	1	1	1	1	3	2	1

List of Experiments:

PART-A

Signal analysis using MATLAB software

1. Basic Operations on Matrices.
2. Generation of various signals and sequences: Unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Random signals.
3. a) Operations on signals and sequences: Addition, Multiplication, Scaling, Shifting, Folding.
   b) Computation of Energy and Average Power.
4. Linear Convolution, Auto Correlation and Cross Correlation of Sequences.
5. Find the Fourier Transform of a given signal and plotting its magnitude and phase Spectrums.
6. Generation of Gaussian noise, Computation of its mean, Mean Square Value, Skew, PSD and PDF.

PART-B

Modelling of system and its characteristics using Lab VIEW and Multisim

1. a) Representation of the transfer function in LabVIEW.

b) Conversion of transfer function to state space representation of the system.

2. Plot unit step response of a standard second order system and also finds the characteristics of second order system using LabVIEW.
3. Plot bode plot of given transfer function and also determine the gain and phase margins using LabVIEW.
4. Plot Nyquist plot for given transfer function and to discuss closed loop stability using LabVIEW.
5. Design and develop Low pass and High pass Filter using Multisim.
6. Simulate and study Integrator and Differentiator using Multisim.

Note: Minimum of five experiments in PART-A and five experiments in PART-B

SUGGESTED READING:

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 3rd Edition, 2008.
2. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 5/e, 2012.
3. Jeffrey Travis and Jim Kring, "Lab VIEW for Everyone: Graphical Programming Made Easy and Fun", 3rd Edition, Prentice Hall, 2007.
4. Multisim User Manual – National Instruments, 2009.

Code : 22EGC03

EMPLOYABILITY SKILLS

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: To help the students

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.

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	PSO 1	PSO 2	PSO 3
CO 1	-	1	-	-	-	1	-	2	3	3	1	3	1	1	1
CO 2	-	-	-	-	-	-	-	1	-	2	-	1	1	1	1
CO 3	-	-	-	-	-	1	-	1	2	1	1	3	1	1	1
CO 4	-	1	1	-	-	1	-	2	3	3	1	3	1	1	1
CO 5	-	-	-	-	-	-	-	1	2	2	1	3	1	1	1

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.

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