UG-R22 Curriculum
With effective from 2022-23

Electrical and Electronics 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.
E-mail: principal@cbit.ac.in, Website: www.cbit.ac.in
Phone No. : 040-24193276 / 277 / 279

SCHEME OF INSTRUCTION AND SYLLABI (R-22)

OF

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

IN

ELECTRICAL & ELECTRONICS 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 (Autonomous)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

INSTITUTE VISION AND MISSION

Vision:
To be centre of excellence in technical education and research

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

DEPARTMENT VISION & MISSION

Vision:

To achieve Academic and Professional Excellence in Teaching and Research in the frontier areas of Electrical and Electronics Engineering Vis-a -Vis serve as a Valuable Resource for Industry and Society.

Mission:

Empowering the Faculty and Student Rendezvous to Nurture Interest for Conceptual Keystone, Applied Multidisciplinary Research, and Inspiring Leadership and Efficacious Entrepreneurship culture, Impeccable Innovation in frontier areas to be synergetic with Environmental, Societal and Technological Developments of the National and International community for Universal Intimacy.

M1: Emphasis on providing Strong Theoretical Foundation & Engineering Leadership Eminence, infusion of Creativity and Management skill while maintaining Ethics and Moral for Sustainable Development. **(Individual development**)

M2: Enable the Faculty and Student Interactions to trigger interest for Applied Multidisciplinary Research and Entrepreneurship Culture resulting in Significant Advancement of the field of Specialization with Involvement of Industries and Collaborative Educational Networks. **(Sense of Ownership, Networking and Eco system Development)**

M3: Extend the Conducive Neighbourhoods for Innovation in frontier areas to keep pace with Environmental, Societal and Technological Developments of the National and International Community to Serve Humanity. **(Service to Society, Atmanirbhar Bharat)**

PROGRAME EDUCATIONAL OBJECTIVES (PEOS):

- **PEO1-** Graduates will Ennoble in offering Design solutions for Complex Engineering Problems using appropriate modern Software tools, with the specified need of the Industry and Protagonist in transforming the Society into a Knowledge Society.

- **PEO2-** Graduates will Elevate Engineering Leadership and will be recognized as Experts working in in Government, Consulting firms, International organizations with their Creativity in Design of Experiments, Analysis and Interpretation of Data and Synthesis of Information.

- **PEO 3-** Graduates will Exalt in their Professional career by Persistence in Team work, Ethical behavior, Proactive involvement, and Effective Communication.
- **PEO 4-** Graduate will Excel by becoming Researches , Professors and Entrepreneurs who will create and Disseminate new knowledge in the frontier areas of Engineering , Technology and Management

PROGRAM OUTCOMES (POs):

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem Analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOS):

PSO 1: Evaluate complex Engineering Problems to meet the distinct need of Industry & Society, by utilizing knowledge of Mathematics, Science, Emerging Technologies such as AI, Block chain & IT tools.

PSO 2: Exhibit Latent talent in understanding the Engineering and Administration standards at work place as a team leader to manage Projects in the Multi-Disciplinary Environments.

PSO 3: Establish Engineering Expertise in Power system, Machines and Drives Systems and also Pursue Research in the Frontier areas such as Embedded systems, Renewable Energy, E-Mobility and Smart grid.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC02	Calculus	3	1	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	-	50	-	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	-	100	-	3
9	22EEC02	Basic Electrical Engineering Lab	0	0	2	3	50	50	1
TOTAL			**10**	**5**	**13**	**-**	**460**	**390**	**21.5**
Clock Hours Per Week: 28									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T:Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

22MTC02

CALCULUS
(EEE)

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

COURSE OBJECTIVES: This course aims to:

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

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

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

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	3	3	3	1	-	-	-	-	-	-	-	1

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22CY C01

CHEMISTRY
(EEE)

Instruction:	3L Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	60 Marks
Continuous Internal Evaluation:	40 Marks
Credits:	3

COURSE OBJECTIVES: This course aims

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 the completion of this course, the 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/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	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 G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS

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

22EEC01

BASIC ELECTRICAL ENGINEERING

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

COURSE OBJECTIVES: This course aims to

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

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

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

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	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

1 - Slightly; 2 - Moderately; 3 - Substantially

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

22CSC01

PROBLEM SOLVING AND PROGRAMMING

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

COURSE OBJECTIVES: This course aims to

1. Develop logical skills and basic technical skills so that students should be able to solve basic computational problems.
2. Learn any basic programming language.

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

1. Understand real world problems and develop computer solutions for those problems.
2. Understand the basics of Python.
3. Apply Python for solving basic programming solutions.
4. Create algorithms/flowcharts for solving real-time problems.
5. Build and manage dictionaries to manage data.
6. Handle data using files.

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
1	3	1	1	-	1	-	-	-	-	-	-	1
2	3	1	1	-	1	-	-	-	-	-	-	1
3	3	1	1	-	1	-	-	-	-	-	-	1
4	3	1	1	-	1	-	-	-	-	-	-	1
5	3	1	1	-	1	-	-	-	-	-	-	1
6	3	1	1	-	1	-	-	-	-	-	-	1

UNIT I:

Introduction to Programming - *Evolution of languages*: Machine, Assembly and High-level languages. *Software requirements for programming*: OS, compiler, linker, loader, editor. Design specification: Algorithms and Flowcharts.

UNIT II:

Data Types and Operators, Variable, Sequences and Iteration - Data types, Expressions, Precedence Rules, Operators: arithmetic, relational, logical, bit-wise and miscellaneous operators; local variable, global variables, List, String, Tuples, Sequence mutation and accumulating patterns.

UNIT III:

Conditional Statement, Loops, Arrays and Strings, user-defined Data Types - if..else, for, while, nested iteration, Concept and use of arrays, declaration and usage of arrays, 2-dimensional arrays, different types of user defined data types.

UNIT IV:

Dictionaries and Dictionary Accumulation, Functions/Methods - Dictionary basics, operations, methods, accumulation, advantages of modularizing program into functions, function definition and function invocation. Positional parameters passing arrays to functions, recursion, library functions.

UNIT V:

File Handling and Memory Management - Concepts of files and basic file operations, writing/reading data to/from a .csv file, 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 Course:

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

22CY C02

CHEMISTRY LAB
(EEE)

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: After the completion of this course, the 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/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	3	2	3	-	-	2	2	-	-	-	-	2

List of 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 the 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 the 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 textbook 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	--
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

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

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

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

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: SarvaShikshaAbhiyan, BetiBhachao, BetiPadhao, Ayushman, Bharat, Swachh Bharat, PM AwasYojana, 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 aims to

1. Master the fundamentals of writing Python scripts
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 the completion of this course, the student 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.

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”, Khanna Book Publishing Co., Delhi
2. Jeeva Jose, “Taming Python by Programming”, Khanna Book Publishing Co., Delhi

22MEC37

ROBOTICS AND DRONES LAB

(Common to All Branches)

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

COURSE OBJECTIVES: This course aims 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 the completion of this course, the student 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.

CO-PO Articulation Matrix:

PO#/ CO#	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12
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**

LAB 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
11. 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 Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	50 Marks
Credits	1

COURSE OBJECTIVES: This course aims to

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

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

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

1 - Slightly; 2 - Moderately; 3 - Substantially

List of Laboratory Experiments/Demonstrations:

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

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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

B.E. –ELECTRICAL & ELECTRONICS ENGINEERING

SEMESTER –II

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	22MTC05	Vector Calculus and Differential Equations	3	1	0	3	40	60	4
2	22PYC06	Electromagnetic Theory and Quantum Mechanics	3	0	0	3	60	40	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**	**24**	**380**	**420**	**19.5**

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

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

22MTC05

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS (EEE)

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

COURSE OBJECTIVES: This course aims 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 the completion of this course, the student 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.

22PYC06

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS
(ECE & EEE)

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

COURSE OBJECTIVES: This course aims to:

The objectives of the course is to make the student

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

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

1. Interpret the wave nature of the light
2. Extend the laws of electric and magnetic fields for wireless communication
3. Explain the principles of lasers and fiber optic communication
4. Find the applications of quantum mechanics
5. Identify semiconductors for engineering applications

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	1	1	1	1	2	2	1	1	2	1	2
C02	3	2	2	1	1	1	1	1	1	2	2	3
C03	3	1	2	1	2	2	2	1	2	2	2	2
C04	2	2	1	1	1	1	1	1	1	2	1	2
C05	3	2	2	2	2	1	2	2	1	2	1	2

UNIT-I

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

UNIT-II

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

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

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

UNIT-III

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

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

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 aims 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 the completion of this course, the student 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
(Common to All Branches)

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

COURSE OBJECTIVES: This course aims 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 the completion of this course, the student will be able
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/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	1	1	1	2	3	3	2	3
CO 2	1	1	1	1	-	1	1	1	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, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP.1995.

SUGGESTED READINGS:

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, 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 aims to:

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

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

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

CO-PO Articulation Matrix

CO/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	2	2	3	1	3	1	3	3	2	1	2
C02	3	2	1	2	2	2	1	2	2	1	1	3
C03	3	2	3	2	3	1	2	2	3	2	1	2
C04	3	3	2	2	2	1	2	3	2	1	1	3
C05	3	1	2	3	2	1	1	2	2	2	1	2

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 aims to

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

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

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

CO-PO Articulation Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	2	2	3	1	3	1	3	3	2	1	2
C02	3	2	1	2	2	2	1	2	2	1	1	3
C03	3	2	3	2	3	1	2	2	3	2	1	2
C04	3	3	2	2	2	1	2	3	2	1	1	3
C05	3	1	2	3	2	1	1	2	2	2	1	2

Experiments

1. Error Analysis : Estimation of errors in the determination of time period of a torsional pendulum
2. Newton's Rings : Determination of wavelength of given monochromatic source
3. Single Slit Diffraction : Determination of wavelength of given monochromatic source
4. Diffraction Grating : Determination of wavelengths of two yellow lines of light of mercury lamp
5. Malus's Law : Verification of Malus's law
6. Double Refraction : Determination of refractive indices of O-ray and E-ray of given calcite crystal
7. Polari meter : 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
(Common to All Branches)

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

COURSE OBJECTIVES: This course aims to

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To listen to listening comprehension 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 behavior while developing their ability to discuss in groups and making oral presentations.

COURSE OUTCOMES: After the completion of this course, the student 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 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/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	-	-	-	1	1	-	1
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

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 Software available in (K-van solutions)
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 representation.

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. PriyadarshiPatnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd. 2011
4. ArunaKoneru, Professional Speaking Skills, Oxford University Press, 2016

22MEC01

CAD AND DRAFTING

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

COURSE OBJECTIVES: This course aims 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 the completion of this course, the student 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-PSO Correlation Matrix

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

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

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)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
(Inline with AICTE Model Curriculum with effect from AY 2022-23)

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	22MTC09	Applied Mathematics	3	1	-	3	40	60	4
2	22CSC29	C and Data Structures	3	-	-	3	40	60	3
3	22EEC03	Electrical Circuit Analysis	3	-	-	3	40	60	3
4	22EEC04	Electromagnetic Fields	3	-	-	3	40	60	3
5	22EEC05	Electrical Measurements and Instrumentation	3	-	-	3	40	60	3
6	22EEC06	Analog Electronic Circuits	3	-	-	3	40	60	3
7	22CEM01	Environmental Science	2	-	-	2	----	50	NC
PRACTICAL									
8	22EEC07	Electrical Circuits and Measurements Lab	-	-	3	3	50	50	1.5
9	22EEC08	Analog Electronic Circuits Lab	-	-	3	3	50	50	1.5
10	22CSC30	C and Data Structures Lab	-	-	2	3	50	50	1
11	22EEI01	MOOCs/Training/ Internship	2-3 weeks/90 hours				50	-	2
Total			**20**	**1**	**8**	**-**	**440**	**560**	**25**
Clock Hours Per Week: 29									

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

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

22MTC09

APPLIED MATHEMATICS
(For EEE)

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

Prerequisites:

The Student should be familiar with Differentiation, Integration and basic Linear Equations.

COURSE OBJECTIVES: This course aims to:

1. To learn the Laplace and Z- Transform concepts.
2. To explain the expansion of functions in sine and cosine series.
3. To able to solve Linear and Non-Linear partial differential equations and fitting the data in Linear and Non-Linear Models.

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

1. Find Laplace, Inverse Laplace and solution of engineering problems.
2. Find the solution of Difference Equation.
3. Calculate the Euler's coefficients for Fourier series expansion of a function.
4. Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
5. Analyze the coefficient of correlation, regression and fitting of the data by various methods.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	-	2	2	-	1
CO2	3	3	2	3	-	-	-	-	-	-	-	2	2	-	1
CO3	3	2	2	3	-	-	-	-	-	-	-	2	2	-	1
CO4	2	3	3	2	-	-	-	-	-	-	-	2	2	-	1
CO5	3	2	3	2	-	-	-	-	-	-	-	2	2	-	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, Transforms of integrals, 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, Solutions of Ordinary Differential Equations by Laplace Transform method. Laplace transform of Unit step and Unit Impulse function.

UNIT-II: Z-Transforms

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

UNIT-III: Fourier Series

Periodic functions, Euler's formulae, Condition for a Fourier series expansion, Fourier series of Functions having points of discontinuity even and odd functions, Change of interval, Half range Sine & Cosine Series

UNIT-IV: Partial Differential Equations

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

UNIT-V: Curve Fitting

Correlation, coefficient of Correlation, Linear Regression, Regression coefficients, Properties of Regression Coefficients. Curve fitting by the Method of Least Squares, Fitting of Straight lines, Second degree parabola and curve
$y=ae^{bx}$, $y=ax^{b}$, and $y=ab^{x}$.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2017.
2. 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. S.S. Sastry, "Introductory methods of numerical analysis", PHI, 4th Edition, 2005.

22CSC29

C AND DATA STRUCTURES

(Common for ECE and EEE)

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

Prerequisite: Students should have Fundamental knowledge in Problem Solving and Programming

COURSE OBJECTIVES: This course aims to:

1. Discuss the concepts of Functions, Arrays, Pointers and Structures.
2. Familiarize with Stack, Queue and Linked lists data structures.
3. Explain the concepts of non-linear data structures like graphs and trees.

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

1. 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 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	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	3	1	-	1	-	-	-	-	-	-	-	2	-
CO 3	3	3	3	1	1	2	-	-	-	-	-	-	-	2	-
CO 4	3	3	3	1	-	1	-	-	-	-	-	-	-	1	-
CO 5	3	3	3	1	-	-	-	-	-	-	-	-	-	1	-

1 - Slightly; 2 - Moderately; 3 - Substantially

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", 2nd Edition, Oxford University Press 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata McGraw Hill.
3. A.K. Sharma, "Computer Fundamentals and Programming in C", University Press, 2nd Edition.

SUGGESTED READING:

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

NPTEL Courses:

S.No	NPTEL Course Name	Instructor	Host Institute
1	Programming and Data Structure, https://nptel.ac.in/courses/106105085	Dr. P.P. Chakraborty	IIT Kharagpur
2	Programming, Data Structures and Algorithms using C https://archive.nptel.ac.in/courses/106/106/106106127	Prof. Shankar Balachandran	IIT, Madras

22EEC03

ELECTRICAL CIRCUIT ANALYSIS

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

Prerequisite: Students should have fundamental knowledge in Basic Electrical Engineering and concepts of Calculus in Mathematics.

COURSE OBJECTIVES: This course aims to

1. To study the nature of different circuit elements, laws and network theorems.
2. To study transient and steady state response of circuits with initial conditions & forcing functions
3. To learn the Laplace transforms and two-port networks.

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

1. Calculate the response of RLC networks with sinusoidal input at steady state & resonance conditions and to analyze three-phase circuits with different loads
2. Apply various network analysis techniques to find the responses in the circuits with dependent and independent sources.
3. Determine time constant, steady state and transient responses of RL, RC, RLC networks with initial conditions of network elements.
4. Evaluate the response of electrical circuits with Laplace transformation using initial & final value theorems and to obtain the pole-zero diagrams using network functions.
5. Find the impedance, admittance, ABCD, h and g- parameters of given two-port network and interconnected two-port networks.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Sinusoidal Steady State Analysis: Review of AC fundamentals, Steady state response of RLC networks with sinusoidal excitations, average power and complex power, series and parallel resonance, three phase circuits with balanced & unbalanced loads,

UNIT -II

Network Theorems: Node and Mesh Analysis, Analysis with dependent current and voltage sources, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation and Milliman's theorems.

UNIT -III

Solution of First and Second Order Networks: Solution of first and second order differential equations for series and parallel RL, RC, RLC circuits, initial and final conditions in network elements, forced and force-free responses, time constant, steady state and transient state responses.

UNIT -IV

Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, inverse Laplace Transform, transformed network with initial conditions. Transfer function representation, Poles and Zeros.

UNIT -V

Two Port Networks: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two-port networks.

TEXT BOOKS:

1. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall, 2015.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", 6th Edition, McGraw Hill Education, 2019.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", 8th Edition, McGraw Hill Education, 2013.
4. D. Roy Choudhury, "Networks and Systems", 2ndEdition, New Age International, 2010.

SUGGESTED READING:

1. Robert L. Boylestad, "Introductory Circuit Analysis", 13th Edition, Pearson Education, 2011.
2. Sudhakar and Shyam Mohan, "Circuits & Networks", 5th Edition, Tata McGraw Hill Education, 2017.
3. Asfaq Hussain, "Networks and Systems", 2nd Edition, Khanna Publishing House, 2021.

NPTEL Courses:

S.No.	NPTEL Course Name	Instructor	Host Institute
1	Basic Circuit Theory https://archive.nptel.ac.in/courses/108/104/108104139/	Prof. Ankush Sharma	IIT, Kanpur
2	Basic Electrical Circuits https://nptel.ac.in/courses/117106108	Dr. Gajendranath Chowdary, Dr. Nagendra Krishnapura	IIT, Madras
3	Network Analysis https://nptel.ac.in/courses/108105159	Dr. T. K. Bhattacharya	IIT, Kharagpur

22EEC04

ELECTROMAGNETIC FIELDS

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

Prerequisite: Students should have Fundamental knowledge in calculus and vector algebra.

COURSE OBJECTIVES: This course aims to

1. To understand coordinate systems, vector calculus and their applications to analyze electrostatic and magnetic fields.
2. To figure out Maxwell's equations, uniform plane wave and its propagation through different media.
3. To know the sources, effects & control techniques of EMI & EMC.

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

1. Understand the basic concepts of vector calculus, various coordinate systems and apply them appropriately for solving electromagnetic field problems.
2. Obtain the physical quantities like field intensity, flux density and potential due to various types of charge distributions in electric and magnetic fields using fundamental laws.
3. Differentiate between conduction & convections currents, and describe the behavior of static electric & magnetic fields in different media, boundary conditions and acquire the knowledge about energy storing elements.
4. Illustrate Maxwell's equations and their application to time-harmonic fields, wave propagation in different media and Poynting's power-balance theorem.
5. Recognize what is EMI & EMC, sources & effects of Electromagnetic Interferences in inter and intra systems and various methods to control EMI

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Orthogonal Coordinate Systems: Review of Vector Calculus, Rectangular, Cylindrical, Spherical Coordinate systems; Line, Surface and Volume integrals; Operator Del, Gradient, Divergence, Curl & Laplacian of a field; Divergence and Stoke's theorems.

Electrostatic fields: Various charge configurations, Coulomb's law, Electric field intensity and flux density of different charge distributions, Gauss's law, Integral and Point form of Maxwell's Electrostatic Equation.

UNIT -II

Electrostatic Field in Materials: Electrical Potential, Capacitance of Parallel plate capacitor, Equipotential lines, Properties of materials, convection and conduction currents, conductors, dielectric constant, continuity equation and relaxation time, boundary conditions, Poisson's and Laplace's equations, Uniqueness theorem.

UNIT -III

Magneto Static Fields: Biot-Savart's law, Ampere's law, Displacement current, Magnetic Scalar and Vector Potentials, boundary conditions, Forces in Magnetic fields, Lorentz force equation, Force between parallel conductors, Inductance Calculations (Solenoid, Toroid), Mutual Inductance, Coefficient of Coupling.

UNIT -IV

Time Varying Electromagnetic Fields: Faraday's laws of electromagnetic induction, Final forms of Maxwell's Equations, Power and Poynting theorem, Time-Harmonic Electromagnetic fields, Wave equations (One dimension), Plane Wave, Propagation in perfect and lossy-dielectrics.

UNIT -V

Electromagnetic Interference and Compatibility (Theoretical Aspects only): Introduction to Electromagnetic Interference and Electromagnetic Compatibility (EMI & EMC)- Sources and Characteristics of EMI, Control Techniques of EMI, Grounding, Shielding, Filtering. Introduction to numerical electromagnetics.

TEXT BOOKS:

1. Hayt W.H and J.A Buck, “Engineering Electromagnetics”, 8th Edition, Tata McGraw Hill, 2018.
2. Sadiku, M.N.O, S.V. Kulkarni, “Principles of Electromagnetics”, 7th Edition, Oxford University press, 2018.

SUGGESTED READINGS:

1. S. P. Seth, “Elements of Electromagnetic Fields", Danpat Rai & Co, 2011.
2. David K. Cheng, “Field and Wave Electromagnetics”, 2nd Edition, Pearson Education 2014.
3. Ashutosh Pramanik, “Electromagnetism Theory and Applications”, 3rd Edition, PHI Pvt. Ltd., 2015.
4. R.L. Yadava, “Electromagnetic Fields & Waves”, Khanna Publishing House,
5. Narayana Rao, “Engineering Electromagnetics”, PHI Pvt. Ltd

NPTEL Courses:

S.No.	NPTEL Course Name	Instructor	Host Institute
1	Electromagnetic Theory https://nptel.ac.in/courses/115101005	Prof. D.K. Ghosh	IIT, Bombay
2	Electromagnetic Theory https://nptel.ac.in/courses/108104087	Dr. Pradeep Kumar K	IIT, Kanpur
3	Electromagnetic Fields https://archive.nptel.ac.in/courses/108/106/108106073/	Dr.Hari Sankar Ramachandran	IIT, Madras

22EEC05

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

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

Prerequisite: Students should have

1. Fundamental knowledge in calculus and complex algebra,
2. Electromagnetism and circuit theory concepts.

COURSE OBJECTIVES: This course aims to:

1. To understand the principle of operation of various electrical Instruments
2. To measure electrical and magnetic parameters by demonstrating experimental setups
3. To introduce transducers and digital instruments with their working principle

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

1. Identify a suitable instrument to measure a given electrical parameter.
2. Analyze the working principle by using suitable torque equations for DC and AC Instruments.
3. Design Bridge Circuits for measuring passive electrical parameters.
4. Distinguish between electrical and magnetic measurements and their instruments.
5. Select an Electrical transducer for a given physical quantity measurement.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Introduction to Measurements: Objectives of measurement, static and dynamic characteristics, accuracy, precision, significant figures, errors and their classification, Standard Cell and Standard Resistance.
Instruments-1: Types of instruments, classification of instruments based on type of measurement and principle of working (PMMC, MI, Dynamometer, Induction and Electrostatic), types of torques (torque equations for MC, MI and dynamometer type instruments).

UNIT -II

Instruments-2: Single phase Induction type energy meter, concepts of driving torque & braking torque equations, (no derivation) ; Errors and their Compensation, Single phase Dynamometer type Power factor meter, Weston type frequency meter. Construction & theory of Instrument Transformers, Equations for ratio and phase angle error of C.T & P.T (Elementary treatment only).

UNIT -III

Resistance, Inductance and Capacitance parameters: Classification of resistance measuring methods Kelvin's double bridge, Wheatstone bridge and Meggar. Measurement of inductance using Maxwell's inductance bridge, Anderson's bridge, Measurement of capacitance using De-Sauty's bridge and Schering bridge, merits and demerits, Q-meter, measurement of relative permittivity, applications and related numerical problems.

UNIT -IV

Measurements of Magnetic and Electric Parameters: Ballistic galvanometer- Principle of operation, construction and applications of Ballistic galvanometer, flux meter its construction and principle of operation. Epstein square bridge for measuring Iron losses, Potentiometers, -Principle - Classification – Salient features related to Practical applicability**.**

UNIT -V

Introduction to Digital Instruments (DVM and Transducers): Introduction to digital Instruments, Digital Voltmeters (DVM), Range extension of DVM, display, resolution, related numerical problems on DVM. Digital Multimeters.

Transducers: Introduction, Role of Transducers in measurement system, Strain Gauge, Linear variable Differential transformer(LVDT), Piezoelectric transducer, Temperature transducers, bimetallic strip, Thermocouples, Resistance Temperature Detectors(RTD), Thermostats, Radiation pyrometers.

TEXT BOOKS:

1. F.W. Golding and Widdis, “Electrical Measurements and measuring Instruments”, A.H. Wheeler & Co., Jan-2011
2. A.K. Sawhney, “A Course in Electrical and Electronics Measurements and Instrumentation”, 22ndEdition, Dhanapat Rai & Sons, New Delhi,2015.
3. CT. Baldwin, “Fundamentals of Electrical measurements”, Kalyani publications, 2001.

SUGGESTED READINGS:

1. Helfrick, Albert D. Cooper, William D., “Modern Electronic Instrumentation and Measurement Techniques”, PHI Publications, Jan-2015
2. Stanley Wold, Richard F.M. Smith, “Student reference manual for Electronic Instrumentation Laboratories”, 2nd Edition, PHI. Alan.
3. S. Morris, “Essence of Measurement”, PHI, Feb-1996

NPTEL Courses:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	EMI	Dr. Avishek Chattergee	IITKGP
2	Industrial Instrumentation	Dr. Alok Barua	IITKGP

22EEC06

ANALOG ELECTRONIC CIRCUITS

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

Prerequisite: Students should have a prior knowledge of semiconductor Physics and basics of circuit theory.

COURSE OBJECTIVES: This course aims to

1. To understand the V-I characteristics of diodes, BJTs, MOSFETs and the biasing techniques of transistors and MOSFETs.
2. To understand the functioning, DC & AC characteristics of Operational Amplifiers (Op-Amps).
3. To Study the linear &non-linear applications of Op-Amps.

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

1. Comprehend the V-I characteristics of Diode and its applications.
2. Understand the V-I characteristics of BJT & MOSFET and to analyze the significance of operating point in the biasing techniques of BJT & MOSFET.
3. Apply the knowledge of differential amplifiers to understand the basic characteristics of Operational Amplifiers (Op-Amps) and their significance.
4. Design and analyze linear application circuits of Op-Amp like amplifiers, Integrator, differentiator, filters, and regulators.
5. Design and analyze non-linear application circuits of Op-Amps and design stable and mono-stable modes of 555 timer circuit.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Diode Characteristics and Applications: P-N junction diode- VI characteristics of a diode, Half-wave and Full-wave rectifiers, operation, performance characteristics, ripple factor calculations, C filter, Zener diode - VI characteristics, Regulator.

UNIT -II

BJT and MOSFET Circuits: BJTs: Structure and Operation of a BJT, Modes of transistor operation, Early effect, BJT input and output characteristics of CE, configuration, BJT as a switch, CE amplifier, small-signal model, significance of DC operating point, biasing circuits- Collector to base and voltage divider, numerical problems.

MOSFETs: Structure-Enhancement & Depletion mode MOSFETs and VI characteristics, MOSFET as a switch, MOSFET as an amplifier- common-source, biasing circuits- voltage divider numerical problems.

UNIT -III

Operational Amplifier (Op-Amp) Characteristics: Block diagram of an operational amplifier, ideal Op-Amp-characteristics, non-idealities in an Op-Amps - open loop voltage gain , output impedance, input impedance ,Output offset voltage, input bias current, input offset current, gain bandwidth product, common mode rejection ratio, slew rate, Frequency response, Stability.

Basic OP-Amp Applications: Inverting and non-inverting amplifier with ideal Op-Amps, voltage follower, current to voltage converter, voltage to current converter.

UNIT -IV

Linear Applications of Op-Amps: Summing amplifier, differential amplifier, instrumentation amplifier, ideal and practical integrator and differentiators, Active filters- First order RC, oscillators (Wein bridge).

UNIT -V

Applications of Op-Amps: Hysteretic Comparator, Zero Crossing Detector, Square-wave, and triangular-wave generators. Precision rectifier, Sample and Hold circuit, clamping and clipping circuits.

555 Timer: Functional diagram, Modes of operation- astable, mono stable.

TEXT BOOKS:

1. Robert L. Boylestad, "Electronic Devices and Circuit Theory", 11th Edition, PHI, 2015.
2. Gayakwad R.A. “Op-Amps and Linear Integrated Circuits”, 4th Edition, PHI, 2015.
3. Roy Choudhury, Shail B. Jain, “Linear Integrated Circuits”, 4th Edition, New Age Intern. (P) Ltd., 2002.
4. Malvino Albert Paul, “Electronic Principles”, 7th Edition, Tata McGraw Hill, 2006.
5. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, 2nd Edition, McGraw Hill U. S., 2013.

SUGGESTED READINGS:

1. Millman and Halkias, “Electronic Devices and Circuits”, 4th Edition, McGraw Hill Publication 2015.
2. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008.
3. Coughlin and Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, 6th Edition, PHI, 2003.

NPTEL Courses:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Analog Circuits	Prof. Jayanta Mukherjee	IIT Bombay
2	Analog Electronic Circuits	Prof. Shouribrata	IIT Delhi

22CEM01

ENVIRONMENTAL SCIENCE

(Mandatory Course)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	-

Prerequisite: None

COURSE OBJECTIVES: This course aims to

1. Identify environmental problems arising due to engineering and technological activities and become aware of the importance of eco system and biodiversity for maintaining ecological balance.
2. Identify the threats and solve the issues of biodiversity, learn about various attributes of pollution management and waste management practices.
3. Contribute for capacity building of nation for arresting and/or managing environmental disasters.

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

1. Identify the natural resources and realize the importance of water, food, forest, mineral, energy, land resources and effects of over utilization.
2. Understand the concept of ecosystems and realize the importance of interlinking food chains.
3. Contribute for the conservation of bio-diversity.
4. Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
5. Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.

CO-PO Articulation Matrix

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT -II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT -III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT -IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT -V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

TEXT BOOKS:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria & Sons, 2009.

SUGGESTED READING:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006

22EEC07

ELECTRICAL CIRCUITS AND MEASUREMENTS LAB

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

Prerequisite: Students should have.

1. Fundamental Knowledge in Calculus and Complex Algebra,
2. Electromagnetism and Circuit Theory Concepts.

COURSE OBJECTIVES: This course aims to

1. To plot the frequency response & locus diagrams of first and second-order circuits
2. To verify various circuit theorems and to determine different parameters of a two-port network.
3. To measure the unknown values of different electrical elements and to become familiar with different transducers.

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

1. Obtain and plot the frequency response and locus diagrams of RLC circuits.
2. Verify various circuit theorems.
3. Determine various two-port network parameters.
4. Validate DC and AC bridges for measuring unknown electrical parameters and demonstrate the principles of magnetic measurements.
5. Demonstrate the measurement of non-electrical quantity with an appropriate transducer, to study the operation of megger, CT & PT and to calibrate energy meter.

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

1 - Slightly; 2 - Moderately; 3 – Substantially

List of Experiments:

Part-A

1. Frequency response of RLC series circuit.
2. Frequency response of RLC parallel circuit.
3. Locus diagrams of RL & RC circuits.
4. Verification of Maximum power transfer theorem.
5. Verification of Milliman's & Compensation theorems.
6. Determination of Z, Y, ABCD & h-parameters of two-port network.
7. Determination of parameters of two 2-port networks connected in Series, parallel and cascade.

Part-B

1. Determination of unknown low resistance using Kelvin's double bridge. Measurement of unknown Inductance using Maxwell's bridge and validating with an LCR meter.
2. Determination of unknown inductance using Anderson's bridge and validating with an LCR meter.
3. Determination of unknown capacitance using Schering Bridge and validating with LCR meter.
4. Measurement of iron losses using Epstein's square bridge.
5. Measurement of strain using a strain gauge.
6. Measurement of Displacement using LVDT.
7. Measurement of unknown voltage using D.C Crompton's potentiometer.
8. Study of analog hand-driven electrical Megger
9. Study of measurements with digital current and potential transformers.
10. Calibration of three phase energy meter.

Note: Five experiments from Part-A and Part-B should be conducted in the semester**.**

22EEC08

ANALOG ELECTRONIC CIRCUITS LAB

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

Prerequisite: Students should have a prior knowledge of semiconductor Physics and basics of circuit theory.

COURSE OBJECTIVES: This course aims to:
1. To understand the V-I Characteristics of diode, transistor and MOSFET.
2. To understand the frequency response of BJT, FET amplifiers.
3. To design linear and non-linear applications of Op-Amp.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Demonstrate the working principle of PN junction diode, transistor and MOSFET from their V-I characteristics.
2. Realize half wave and Full wave rectifiers for C filter combinations.
3. Analyze the significance of choosing a DC operating point for a transistor/MOSFET and to analyze the frequency response of CE amplifier.
4. Design of linear and non-applications of Op-Amps.
5. Design a 555 Timer in A stable mode to produce pulses for Pulse Width Modulation (PWM) Schemes.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

List of Experiments:

Part A

1. V-I characteristics of (Silicon and Germanium) diodes and measurement of static and dynamic resistance.
2. Zener diode characteristics and its application as a voltage regulator.
3. Rectifier Circuits-
    a. Design, realization, and performance evaluation of half wave rectifier - without and with C-filter.
    b. Design, realization, and performance evaluation of Full wave rectifier- without and with C-filter.
4. Plotting the characteristics of BJT and MOSFET.
5. Design of Biasing circuits for BJT
6. Design of Biasing Circuits for MOSFET
7. Design and Frequency response of Common Emitter BJT amplifier and measurement of Gain, Bandwidth, Input and Output impedances.

Part B

1. Measurements of Op-Amp parameters
2. Design of integrator and differentiator using Op-Amp.
3. Design of Active filters –LPF & HPF

4. Generation of triangular, sine and square wave using IC's.
5. Design of Clampers using Op-Amps.
6. Design of Clippers using Op-Amps.
7. Analysis of Hysteric comparator using Schmitt Trigger circuit.
8. Design of 555 Timer in A stable mode

Note: At least FOUR experiments from Part-A and SIX from Part-B should be conducted in the semester

22CSC30

C AND DATA STRUCTURES LAB

Instruction	2P Hours for week
Duration of SEE	3 Hours
SEE	50Marks
CIE	50Marks
Credits	1

Prerequisite: None

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: After the completion of this course, the student 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 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	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO 3	2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO 4	2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO 5	3	3	3	1	-	-	-	-	-	-	-	-	-	1	-

1 - Slightly; 2 - Moderately; 3 - Substantially

List of 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”, 2nd Edition, Oxford University Press 2011.
2. E. Bala Guruswamy, “C and Data Structures”, 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, “Computer Fundamentals and Programming in C”, University Press, 2nd Edition.

SUGGESTED READING:

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

NPTEL Courses:

S.No.	NPTEL Course Name	Instructor	Host Institute
1	Programming and Data Structure, https://nptel.ac.in/courses/106105085	Dr. P.P. Chakraborty	IIT Kharagpur
2	Programming, Data Structures and Algorithms using C https://archive.nptel.ac.in/courses/106/106/106106127	Prof. Shankar Balachandran	IIT, Madras

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

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

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	22EEC09	Electrical Machines-I	3	-	-	3	40	60	3
2	22EEC10	Power Systems I	3	-	-	3	40	60	3
3	22EEC11	Control Systems	3	-	-	3	40	60	3
4	22EEC12	Digital Electronics	3	-	-	3	40	60	3
5	22EEC13	Signals and Systems	3	-	-	3	40	60	3
6	22EEM01	Universal Human Values-II: Understanding Harmony		1	-	-	50	-	1
PRACTICAL									
7	22EEC14	Electrical Machines-I Lab	-	-	3	3	50	50	1.5
8	22EEC15	Control Systems Lab	-	-	3	3	50	50	1.5
9	22EEC16	Digital Electronics Lab	-	-	3	3	50	50	1.5
Total			**16**	**-**	**9**	**-**	**400**	**450**	**20.5**
Clock Hours Per Week: 25									

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

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

22EEC09

ELECTRICAL MACHINES-I

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

Prerequisite: Students should have prior knowledge of Basic Electrical Engineering.

COURSE OBJECTIVES: This course aims to:

1. To inculcate the principles of Electromechanical Energy Conversions.
2. To determine the performance of DC Machines by conducting various tests.
3. To impart the knowledge of transformers and evaluate its performance.

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

1. Comprehend the nomenclature and principles related to the concepts of energy balance and various excited systems
2. Elucidate the principle of operation , characteristics and parallel operation of DC Generators
3. Analyze the starting methods , speed control and testing methods under different conditions of a given DC motor
4. Explain the principle of operation, performance ,testing methods and parallel operation aspects of 1-ph transformer
5. Explore the performance and other aspects of various 3-ph transformer

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Electromechanical energy conversion: Introduction to Magnetic circuits, forces and torques in magnetic field system, energy balance, singly excited and multiple excited magnetic systems, co-energy.

UNIT -II

DC Generators: Review of Constructional features and Principle of operation of a DC machine, armature windings diagram (Lap and Wave winding), analysis of EMF equation of a DC generator, Armature reaction and its effects, process of commutation, methods of improving commutation, methods of excitation and classification of DC generators, voltage build-up in a shunt generator, critical field resistance and critical speed, generator characteristics, losses and efficiency, parallel operation and applications of DC generators.

UNIT -III

DC Motors: Review of Principle of operation, back EMF and significance of back EMF, electromagnetic torque, types of DC motors, characteristics, analysis of speed control methods, necessity of starter, three-point starter and four-point starter, soft starters (elementary treatment only) losses and efficiency, applications of DC motors.

Testing of DC machines: Swinburne's test, brake test, Hopkinson's test, fields test, retardation test and separation of losses.

UNIT -IV

Single Phase Transformer:

Review of Constructional features, principle of operation, EMF equation and ideal transformer, transformer on no-load and on-load and its phasor diagrams. Detailed study of equivalent circuits, voltage regulation and efficiency. All day efficiency, parallel operation of transformer.

Testing of transformer: Polarity test, analysis of open circuit and short circuit test, Sumpner's test, separation of losses.

Auto transformer: Construction, principle, applications, and comparison with two-winding transformers.

UNIT -V

Three-Phase Transformers: Construction, types of connection and their comparative features, Scott connection. Tap-changing transformers: No-load and on-load tap-changing of transformers, Three-winding transformers, cooling of transformers.

TEXT BOOKS:

1. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. H. Cotton, "Advanced Electrical Technology", 7th Edition, Wheeler & Co, CBS publishers, 2005.
4. J.B Gupta, "Theory and performance of electrical machines", 14th Edition, S.K. Kataria & Sons, 2014.

SUGGESTED READINGS:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. Ashfaq Hussain "Electrical Machines", 3rd Edition, Danpat Rai and sons, 2012.

22EEC10

POWER SYSTEMS-I

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

Prerequisite: Students should have knowledge in Electrical Circuit Analysis

COURSE OBJECTIVES: This course aims to:

1. To introduce Generation of power through conventional sources such as: Thermal, Hydro, Nuclear and Renewable energy sources
2. To familiarize mechanical design of transmission lines and cables.
3. To familiarize present practices in tariff calculations and understand the classification and Connection schemes of distribution systems.

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

1. Discuss the construction and operation of conventional and non-conventional sources of energy along with financial management.
2. Determine the line parameters such as inductance and capacitance for different configurations of transmission line.
3. Calculate the sag and tension for given transmission line under different weather conditions.
4. Discuss the operation of underground cables, insulators and calculate the capacitance of cables and string efficiency of insulators.
5. Discuss the different tariff structures, types of costs and general aspects of distribution systems.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Basic Concepts: Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids.

Generation: Thermal- Hydro -Power Plants: Principles, Choice of site, layout and various parts of generating stations, Brief description of Hydro Power Plant Dam, Spillways, Head works, Surge tank, Penstocks, Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses, Brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and Cooling towers.

Nuclear Station: Schematic Arrangement of Nuclear Power Station, Advantages and disadvantages, Types of Nuclear reactors.

UNIT -II

Solar and Wind Generation: Solar cell fundamentals, Solar Cell characteristics, solar cell classification, solar cell, Module, Panel and Array Construction, Maximizing the solar PV output and load matching, Solar PV Systems, Basic Principles of Wind Energy Conversion, The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations.

UNIT -III

Line Parameter Calculations: Inductance & Capacitance calculations of Transmission Line, single-phase and three-phase symmetrical composite conductors, GMD, GMR, Transposition of conductors, bundled conductors, effect of earth capacitance.

UNIT -IV

Over-head Transmission Lines and Cables: Over-head line materials, supports, types, Ground wires, Sag/Tension calculations, Equal / Unequal supports, Effects of wind, ice/Erection Conditions stringing. charts, Insulators, Types, Material for construction, potential distribution over string of insulators, equalizing of potential, Methods.

Underground Cables: Construction of Cables, Insulating Materials for Cables, Classification of Cables, Insulation Resistance of a Single-Core Cable, Capacitance of a Single-Core Cable, Dielectric Stress in a Single-Core Cable, Most Economical Conductor Size in a Cable, Grading of Cables, Capacitance Grading, Intersheath grading, Capacitance of 3-Core Cables, Measurements of Ce and Cc.

UNIT -V

Economics of Power Generation: Load curve, Load demand and diversified factors, Base load operation, Types of costs and depreciation calculations; Tariffs, different types of tariffs; Methods of power factor improvement. **General Aspects of Distribution Systems**-Types of Distribution, Ring main & Radial Distribution system, Calculations for Distributor fed at one end, distributor fed at both ends **(AC & DC).**

TEXT BOOKS:

1. J. Giangrande'd. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. C.L. Wadhwa, "Electric Power Systems Theory", New Academic Science Limited, 2012.
3. B.H. Khan, "Non-Conventional Energy Resources" McGraw Hill Education, 2015

SUGGESTED READING:

1. A.R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
2. D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", McGraw Hill, 2003.
3. B.M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012

22EEC11

CONTROL SYSTEMS

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

Prerequisite: Students should have a prior knowledge of Newton's laws of Motion, Circuit theory, Vector Calculus & Differential Equations, Laplace transform and linear algebra.

COURSE OBJECTIVES: This course aims to:
1. To understand different types of linear control systems and their mathematical modeling.
2. To study the stability analysis both in time and frequency domains.
3. To study the concepts of State space representation of Linear Time invariant systems (LTI).

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Demonstrate the characteristics of DC, AC Servo motors and Synchro Pair.
2. Analyze the performance parameters of a given second order plant in the time domain.
3. Analyze the performance of different compensators through its frequency response.
4. Design P, PI, PID and ON/OFF controller of a given system and to distinguish the merits and demerits of these controllers.
5. Demonstrate the effect of damping on the plant using the DC position control system.

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

UNIT -I

Introduction to Control Systems: Open loop, closed loop System with illustrations and other classification of control systems, Impulse response and Transfer Function, Mathematical modeling of Mechanical and Electrical Systems, Analogous Systems, Feedback control characteristics - effects of feedback.

UNIT -II

Mathematical Models of Physical Systems: Introduction of servo motors & Synchro pair, Modeling of armature and field-controlled D.C motors, Block diagram algebra, Signal flow graphs and problems on conversion from block diagram to signal flow graph.

UNIT -III

Time Response Analysis: Standard test signals, Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Static error coefficients and steady state error (for standard test input signals), Performance parameters of a second-order systems based on the time-response. Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, root locus technique, Typical systems analyzed by root locus technique, Response with P, PI & PID controllers.

UNIT -IV

Frequency Response Analysis: Introduction, Frequency domain specifications for a second order system, Relationship between time and frequency response, bode plots, Polar plots, Nyquist stability criterion, Relative stability using Nyquist criterion. Stability analysis of plots based on gain and phase margin, Introduction to Lag and Lead networks and their Transfer functions.

UNIT -V

State Variable Analysis and Introduction to Discrete Control Systems: Concepts of state, state variable, State models of linear time invariant systems, Derivation for state models from transfer functions and differential equations, State transition matrix and its properties, Solution of state equations in time & Laplace domain, Eigenvalues and Stability Analysis, Concept of Controllability and Observability. Introduction to discrete control systems.

TEXT BOOKS:

1. I.J. Nagrath, M. Gopal, "Control System Engineering", 5thEdition, New Age International(P) Limited Publishers, 2008.
2. B.C. Kuo, "Automatic Control Systems", 9th edition, John Wiley, and son's Publishers, 2009.
3. K. Ogata, "Modern Control Systems", 5thEdition, PHI publication, 2010.
4. A. Anand Kumar, "Control Systems", 2ndEdition, PHI publications, 2014.

SUGGESTED READINGS:

1. M. Gopal, "Control Systems Principles and Design", 2nd Edition Tata McGraw Hill, 2003.
2. N.C Jagan "Control Systems", 2nd Edition, BS Publications, 2008.
3. N. Nise, "Control Systems Engineering", 6th Edition, Wiley Publications, 2011.

NPTEL Courses:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Control Engineering	Prof. Ramakrishna Pasumarthi	IITM

22EEC12

DIGITAL ELECTRONICS

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

Prerequisite: Basics of number systems, basics of transistors and MOSFETs

COURSE OBJECTIVES: This course aims to:

1. To demonstrate the working of logic families and logic gates
2. To present design and implementation of combinational and sequential logic circuits.
3. To illustrate the process of A/D and D/A conversions and PLD's in implementing the given logical problems.

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

1. Understand the fundamental concepts and techniques used in logical operations.
2. Analyze and design various combination circuits using k Maps and Q-M method.
3. Design and implement Sequential logic circuits like counters shift register sand sequence generators
4. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
5. Implement PLD's to solve the given logical problems.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Fundamentals of Digital Systems and Logic Families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, and CMOS logic.

UNIT -II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, digital comparator, parity checker/generator, code converters, priority encoders, decoders/Seven segment display device, Q-M method of function realization.

UNIT –III

Sequential Circuits and Systems: A 1-bit memory, the circuit properties of bi-stable latch, the clocked SR flipflop, J- K-T and D-types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, sequence detector, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, applications of counters.

UNIT -IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, analog to digital converters: parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, specifications of A/D converters. - Significance of size of data on the accuracy of conversion.

UNIT -V

Semiconductor memories and Programmable Logic Devices: Introduction to state diagram- Moore and Mealy machine Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic.

TEXT BOOKS:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

SUGGESTED READINGS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. S. Salivahanan “Digital circuits and design”, 4th edition, Vikas Publishing house, 2010.

NPTEL Courses:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Digital Electronic Circuits https://onlinecourses.nptel.ac.in/noc20_ee32/preview	Prof. Goutam Saha	IIT Kharagpur

22EEC13

SIGNALS AND SYSTEMS

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

Prerequisite: Students should have prior knowledge on calculus, ordinary differential equations, Laplace & Z- transforms.

COURSE OBJECTIVES: This course aims to:
1. To know about signal properties and their characteristics for LTI systems in time & frequency domain
2. To elucidate the techniques of Laplace & Z- transforms and their applications on various systems.
3. To study about sampling theorem and different methods to reconstruct the signal.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the classification & properties of signals & systems.
2. Analyze the behavior of LTI systems in continuous and discrete time domain.
3. Representation of continuous & discrete time signals in complex frequency domain
4. Apply Laplace & Z-transforms to analyze the continuous & discrete signals
5. Analyze the concept of sampling theorem and to know about the process of reconstruction.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT -I

Introduction to Signals and Systems: Signals & systems with their examples in various fields-Continuous and Discrete time systems – Representation of Discrete time signals – Unit step -Impulse-Sinusoidal -Complex exponential signals in CT & DT domains-Special time limited signals - Signal properties: Even & Odd signals - Periodic & Aperiodic signals - Energy & Power signals in CT & DT domain- Basic operations on signals-Sketching of signals –System properties : Linearity (Additivity & Homogeneity)-Time invariance -Causality - Stability with examples.

UNIT -II

Behavior of Continuous and Discrete Time LTI Systems: Response of LTI system to arbitrary input signal-Convolution in CT & DT domain-Impulse response –step response – Characterization of stability & causality of an LTI system -System of Interconnections: Cascade & Parallel – System representation through differential and difference equations.

UNIT -III

Fourier series & Fourier Transforms:

Fourier Series: Fourier series representation of periodic signals-Dirichlet's condition – Trigonometric & Exponential Fourier Series-Waveform symmetries – Fourier coefficients –Complex Fourier spectrum-

Fourier Transforms: Introduction- Fourier transform of arbitrary, periodic and standard signals – Properties of Fourier transform – Parseval's theorem.

UNIT -IV

Laplace Transforms & Z-Transforms:

Review of Laplace transforms- Relation between Laplace transform & Fourier transform of a signal-Concept of R.O.C for Laplace transform - Poles and Zeros of rational function of s and their R.OC -Properties of R.O.C - Stability in 's' domain -Laplace transform for LTI systems - Inverse Laplace transforms.

Z-Transforms: Concept of Z-Transform for discrete sequences -Distinction between Laplace -Fourier & Z-Transforms-R.O.C in Z-Transforms -Poles and Zeros of rational function of z and their ROC -Properties of R.O.C

- Stability in Z-domain-Z-transforms for discrete time LTI systems -Inverse Z- Transforms - Properties of Z-Transforms.

UNIT -V

Sampling & Reconstruction: Sampling theorem & its implications - Spectra of sampled signals -Aliasing and its effects -Nyquist rate-Reconstruction: Ideal interpolator -Zero order & First order hold circuits.

TEXT BOOKS:

1. A.V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and Systems", Prentice Hall India, 1997.
2. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Pearson, 2006.
3. Anand Kumar. A, "Signals & Systems", 3rd Edition, Prentice Hall India, 2017.
4. A Nagoor Kani, "Signals & Systems", Tata McGraw Hill Education Private Limited 2010.

SUGGESTED READINGS:

1. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
2. S. Haykin and B. V. Veen, "Signals and Systems", John Wileyand Sons, 2007.
3. Michel J. Robert, "Fundamentals of Signals & Systems", MGH International Edition, 2008.

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 course aims to is 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 After the completion of this course, the 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
CO 2	-	-	1	-	-	1	1	-	1	-	1	1	-	1	1
CO 3	--	-	-	-	-	1	-	-	-	1	-	-	-	1	1
CO 4	-	-	-	-	-	1	1	1	-	-	-	-	-	1	1
CO 5	-	-	-	-	-	1	1	1	-	-	-	-	-	1	1

1 - Slightly; 2 - Moderately; 3 - Substantially

22EEC14

ELECTRICAL MACHINES – I LAB

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

Prerequisite: Students should have the prior knowledge of Basic Electrical Engineering.

COURSE OBJECTIVES: This course aims to:
1. Draw the characteristics of different types of DC generators.
2. Test the DC machines under different loading conditions.
3. Understand the performance of single-phase transformer.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand how to perform experiments to measure and analyze the performance of different types of electrical machines.
2. Realize the performance parameters through experimentation.
3. Understand the Practical aspects of electrical machines and control
4. Obtain the performance characteristics of the given Machine
5. Interpret the experimental data and **drawing conclusions.**

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

1 - Slightly; 2 - Moderately; 3 - Substantially

List of Experiments:
1. OCC and load characteristics of separately excited DC generator.
2. OCC and load characteristics of DC shunt generator.
3. Load characteristics of DC compound generator.
4. Swinburne's test on DC shunt machine to predetermine the efficiency at any given load.
5. Brake test on DC series motor.
6. Hopkinson's test on two identical DC shunt machines.
7. Separation of stray losses of DC shunt machine.
8. Load test on single phase transformers.
9. Sumpner's test on two identical single-phase transformers.
10. Separation of Magnetic losses of transformer.
11. Study of three-phase transformer connections.
12. Demonstration of three-point starter and four-point starter.
13. Study of excitation phenomenon of three-phase transformer.
14. Parallel operation of two single-phase transformers.

Note: At least TEN experiments should be conducted in the semester.

SUGGESTED READING:
1. S.G. Tarnekar, P.K. Kharbanda, "Laboratory course in Electrical engineering", S. Chand & Co 1990

22EEC15

CONTROL SYSTEMS LAB

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

Prerequisite: Students should have a prior knowledge of Newton's laws, Circuit theory, Vector Calculus & Differential Equations, Laplace transform and their properties and linear algebra.

COURSE OBJECTIVES: This course aims to:
1. To understand different types of linear control systems and their mathematical modeling.
2. To study the stability analysis both in time and frequency domains.
3. To study the concepts of State space representation of Linear Time invariant systems (LTI).

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Obtain mathematical models and transfer functions for any electromechanical LTI system.
2. Determine the Transfer function of an LTI system using block diagram & signal flow graph approach.
3. Analyze the given first and second order systems based on their performance parameters & PID controllers.
4. Analyze the absolute and relative stabilities of an LTI system using time and frequency domain techniques and demonstrate the design of compensators.
5. Develop the state space models for various LTI systems and check their Controllability and Observability.

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

1 - Slightly; 2 - Moderately; 3 - Substantially

LIST OF EXPERIMENTS:
1. Characteristics of D.C Servomotor.
2. Characteristics of A.C. Servomotor.
3. Characteristics of Synchro Pair.
4. Performance parameters of a second order system excited with step input for different damping ratios.
5. Frequency response of lag and lead compensating networks.
6. Performance of a temperature control system using P, PI and PID Controllers.
7. Temperature control of a system using relay (ON/OFF Control).
8. Characteristics of magnetic amplifier for series and parallel connections with different values of resistive load.
9. Measurement of step angle for stepper motor.
10. Response of different components of a control system using Linear System Simulator.
11. Demonstration of damping effect on the plant using DC position control system.
12. Study of closed loop speed control of BLDC motor with the effect of PI controller

Note: At least TEN Experiments should be conducted in the semester from the above list of experiments

22EEC16

DIGITAL ELECTRONICS LAB

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

Prerequisite: Basic knowledge on logical operations, basics of logic gates, basics of flip-flops.

COURSE OBJECTIVES: This course aims to:
1. To explain Demorgan's Theorem, SOP, POS forms.
2. To demonstrate implementation of Full/Parallel Adders, Subtractors and Magnitude Comparators, multiplexers, de-multiplexers and decoders using logic gates.
3. To illustrate various flip-flops, shift registers and design different counters.

COURSE OUTCOMES: After the completion of this course, the student will be able to
Demonstrate the truth table of various expressions and combinational circuits using logic gates.
1. Design, test and implement various combinational circuits such as adders, sub tractors, comparators.
2. Apply knowledge of logic gates to design complex logic circuits like multiplexers and demultiplexers.
3. Design, test and implement various sequential circuits using flip-flops
4. Design various logic circuits using shift registers.

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	SO 3
CO 1	2	2	1	1	1	-	-	-	-	-	-	-	1	1	-
CO 2	2	3	3	2	1	-	-	-	-	-	-	-	1	2	-
CO 3	2	3	3	2	1	-	-	-	-	-	-	-	1	3	1
CO 4	2	2	2	2	1	-	-	-	-	-	-	-	1	1	1
CO 5	1	2	2	1	1	-	-	-	-	-	-	-	1	1	1

1 - Slightly; 2 - Moderately; 3 - Substantially

List of Experiments:
1. Verify Demorgan's Theorem for 2 variables.
2. The sum-of product and product-of-sum expressions using gates.
3. Design and implement
    a. Full Adder using basic logic gates.
    b. Full subtractor using basic logic gates
4. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.
5. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.
6. Realize
    a. 4:1 Multiplexer using gates.
    b. 3-variable function using IC 74151(8:1MUX).
7. Realize 1:8 Demux and 3:8 Decoder using IC74138.
8. Realize the following flip-flops using NAND Gates.
    a. Clocked SR Flip-Flop
    b. JK Flip-Flop
9. Realize the following shift registers using IC7474
    a. SISO
    b. SIPO
    c. PISO
    d. PIPO
10. Realize the Ring Counter and Johnson Counter using IC7476.

11. Realize the Mod-N Counter using IC7490.
12. Design of synchronous counters using flip-flops.
13. Design of Asynchronous counters using flip-flops.

Note: At least TEN experiments should be conducted in the Semester

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