Scheme of Instruction and Syllabi

Of

B.E. / B.TECH. I & VIII SEMESTERS

FOR

DEPARTMENT OF CIVIL ENGINEERING – R22 (A)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
Kokapet Village, Gandipet Mandal, Hyderabad– 500 075. Telangana
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMUS)
DEPARTMENT OF CIVIL ENGINEERING

INSTITUTE VISION AND MISSION

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

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

DEPARTMENTVISION AND MISSION

Vision
To strive for excellence in academics, research and consultancy in the field of Civil Engineering and contribute to the sustainable development of the country by producing quality Civil Engineers with professional and ethical values.

Mission
- Maintaining high academic standards to develop analytical thinking and independent judgment among the students so that they are fit for industry and higher studies.
- Promoting skills and values among the students to prepare them as responsible global citizens who can solve complex problems.
- Preparing the students as good individuals and team members with professional attitude, ethics, concern for environment and zeal for lifelong learning who can contribute to society.

PROGRAM EDUCATIONAL OBJECTIVES:

The PEOs are to facilitate the graduating students to

PEO1: Acquire basic knowledge and expertise necessary for professional practice in Civil Engineering for higher studies and research.
PEO2: Attain and practice technical skills to identify, analyze and solve complex problems and issues related to Civil Engineering.
PEO3: Possess a professional attitude as an individual or a team member to work for the betterment of the society and environment.
PEO4: Work with professional ethics as refined technocrats with a thirst for lifelong learning.

PROGRAM SPECIFIC OUTCOMES:
The graduates of this program will:

1. Effectively apply engineering fundamentals for the development and management of eco-friendly Civil engineering systems which benefit the society at large.
2. Develop the ability to provide solutions to complex problems in civil engineering through individual and team work with a spirit for lifelong learning
3. Develop the competence to plan, build and maintain sustainable infrastructural facilities like housing, water management, transportation and geotechnical services.

PROGRAM OUTCOMES:

Engineering graduate will be able to:

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 of 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 public health and safety, and cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. The Engineer and Society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and 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 the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project Management and Finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-Long Learning	Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

About the Department:

The Department of Civil Engineering was established in the Year 1979 with the inception of the Institute. The Department offers a Four-Year Bachelor's Degree Program in Civil Engineering and Two-Year Master's Degree Program in Structural Engineering. In total there are about 500 Students pursuing Bachelor's Degree and 50 Students pursuing Master's Degree in the Department. Many of the Faculty Members hold Higher Degrees from reputed Institutions from India like IITs, NITs, IIITH and State Universities and Abroad. The Department of Civil Engineering has three missions such as excellence in Teaching and Research; Relevance to Industry and Society; contribution to sustainable development. The Department is well equipped with State-of-the-Art laboratories to cater the needs of Teaching, R&D and Consultancy. The Faculty of the Department strive hard to impart the latest technical knowledge to the students and conduct quality research. The faculty offer technical services on live engineering problems to various Government and Private organizations.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.E. –Civil Engineering as per AICTE Model Curriculum 2024-25

DEPARTMENT OF CIVIL ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			SE E in Hours	Maximum Marks		
			L	T	P / D		CIE	SEE	
THEORY									
1	22MTC02	Calculus	3	1	-	3	40	60	4
2	22CYC01	Chemistry	3	-	-	3	40	60	3
3	22EEC01	Basic Electrical Engineering	2	1	-	3	40	60	3
4	22CSC40N	Problem Solving and Programming using Python	2	1	-	3	40	60	3
PRACTICAL									
5	22CYC02	Chemistry Lab	-	-	3	3	50	50	1.5
6	22MBC02N	Community Engagement	-	-	2	-	50	--	1
7	22CSC41N	Problem Solving and Programming using Python Lab	-	-	3	3	50	50	1.5
8	22MEC37N	Robotics and Drones Lab	-	1	3	-	100	--	2.5
9	22EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
TOTAL			**10**	**4**	**13**	**--**	**460**	**390**	**20.5**
Clock hours per week: 27									

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

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

22MTC02

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

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

Course Objectives: To enable the students

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

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

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Text Books:

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

Suggested Reading:

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

22CYC01

CHEMISTRY

(Common to All Branches)

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

Course Objectives: To enable the students to

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

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

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

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 – Markonik off's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds) Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides) Cyclization (Diels - Alder reaction)

UNIT–IV

Water Chemistry:

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

UNIT-V

Engineering Materials and Drugs:

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

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

Photolithography.

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle). Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D. Tuli and R.D. Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

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

22EEC01

BASIC ELECTRICAL ENGINEERING

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

Course Objectives: To enable students 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.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

Text Books:

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

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 201

22CSC40N

PROBLEM SOLVING AND PROGRAMMING USING PYTHON
(For Other Branches)

Instruction	2L + 1T Hours Per Week
Duration of Semester End Examination	3 Hours
Semester End Examination (SEE)	60 Marks
Continuous Internal Evaluation (CIE)	40 Marks
Credits	3

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

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

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	1	-	-	-	-	-	1	-	-	-
CO2	3	3	3	1	1	1	-	-	-	-	-	2	-	-	-
CO3	3	3	3	1	1	1	-	-	-	-	-	2	-	-	-
CO4	3	3	2	1	1	-	-	-	-	-	-	2	-	-	-
CO5	3	3	3	1	2	1	-	-	-	-	-	2	-	-	-

UNIT - I

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

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

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

UNIT – II

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

UNIT – III

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

Decision Control Statements: Selection/Conditional Branching, Loop Control Structures, Nested Loops. Comprehensions: List, Dictionary, Set comprehensions.

UNIT – IV

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

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

UNIT – V

Searching and Sorting Techniques: Linear Search, Binary Search, Selection Sort, Bubble Sort. File Handling: File types, opening and closing files, reading and writing files, file positions.

Text Books:

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

Suggested Reading:

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

Online Resources:

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

22CYC02

CHEMISTRY LAB

(Common to All Branches)

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

Course Objectives : To enable the students

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 analyze the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

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

1. Identify the basic chemical methods to analyze 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.

Chemistry Lab

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

Text Books:

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

Suggested Readings:

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

22MBC02N

COMMUNITY ENGAGEMENT

Instruction	2 Hours Per Week
Duration of Semester End Examination	
Semester End Examination (SEE)	Nil
Continuous Internal Evaluation (CIE)	50 Marks
Credits	1

Course Objectives: The main Objectives of this Course are to:

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

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

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

CO-PO Articulation Matrix

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

Module I
Appreciation of Rural Society

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

Module II
Understanding Rural Economy and Livelihood

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

Module III
Rural Institutions

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

Module IV
Rural Development Programmes

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

Text Books:

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

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

Journals:

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

22CSC41N

PROBLEM SOLVING AND PROGRAMMING USING PYTHON LAB

Instruction	3P Hours Per Week
Duration of Semester End Examination	3 Hours
Semester End Examination (SEE)	50 Marks
Continuous Internal Evaluation (CIE)	50 Marks
Credits	1.5

Prerequisite: Basic Computer Skills.

Course Objectives: This course aims to:

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

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

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

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	1	-	-	-	-	-	-	2	-	-	-
CO2	3	3	3	1	1	1	-	-	-	-	-	2	-	-	-
CO3	3	3	3	1	2	1	-	-	-	-	-	2	-	-	-
CO4	3	3	3	1	1	1	-	-	-	-	-	2	-	-	-
CO5	3	3	3	1	2	1	-	-	-	-	-	2	-	-	-

Laboratory / Practical Experiments:

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

Text Books:

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

Suggested Reading:

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

Online Resources:

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

22MEC37N

ROBOTICS AND DRONES LAB

Instruction	1T + 3P Hours per week
Duration of Semester End Examination	--
Semester End Examination	--
Continuous Internal Evaluation	100 Marks
Credits	2.5

Course Objectives: The objectives of this course are to

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

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

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

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	0	0	1	3	3	1	2	2	1	3
CO2	1	2	2	1	1	0	0	1	3	3	1	2	2	1	3
CO3	1	2	2	1	1	0	0	1	3	3	1	2	3	1	3
CO4	2	2	2	1	1	0	0	1	3	3	1	2	2	1	1
CO5	2	2	2	1	1	0	0	1	3	3	1	2	3	1	3

Lab Experiments:

Experiment No	Title	CO
1.	Introduction to Robotics, Definition and scope of robotics, Robot configurations- Cartesian, cylinder, polar and articulate. Uses and Significance of Robots, Parts of a Robot, Current applications and future trends. Introduction to Arduino, C++, Arduino Programming Environment. Interfacing Arduino with Electronic Devices such as LEDs/Piezo Buzzer	1
2.	Interfacing Arduino with Electronic Devices such as Push Button/Potentiometer	1
3.	Introduction to Sensors, Types of Sensors, Reading Data from Sensors, Interfacing Sensors with Microcontrollers. Interfacing Arduino with Ultrasonic Distance Sensor and Reading Sensor Data on Serial Monitor	2
4.	Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor	2
5.	Interfacing Arduino with Rotary Encoder and Reading Sensor Data on Serial Monitor	2

6.	Introduction to motors, Types of motors, Motor drivers, Interfacing motors with Microcontrollers, Introduction to Li-ion, LIPO batteries, uses and safety precaution. Implement a system that utilizes an Arduino microcontroller to control the precise movement of a servo motor.	3
7.	Implement a system that utilizes an Arduino microcontroller to control the precise and sequential movements of a stepper motor.	3
8.	Construct a two-wheel robot using DC motors controlled by an Arduino microcontroller. Implement a program that allows the robot to execute specific movements. The robot should: i. Move forward with controlled acceleration. ii. Move backward with controlled deceleration.	3
9.	Construct an Obstacle avoidance robot	3
10.	Construct a Pick and place robot	3
11.	Open Cv for image processing: i. Extraction of RGB values of a pixel ii. Create colored shapes and save image iii. Extraction of ROI	4
12.	Assembly of quad copter drone.	5

Open-Ended Project on Autonomous System

Note:

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

Suggested readings

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

22EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2P Hours per Week
Duration of SEE	3 Hours
SEE	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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	2	2	-	-	-	-	2	3	2	2
CO2	3	2	1	-	-	1	2	-	-	-	-	2	3	2	1
CO3	3	2	3	-	-	2	2	-	-	-	-	2	3	2	3
CO4	3	2	2	-	-	2	2	-	-	-	-	2	3	2	2
CO5	3	2	3	-	-	2	2	-	-	-	-	2	3	2	3

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

Scheme of Instructions of II Semester of B.E. –Civil Engineering as per AICTE Model Curriculum 2024-25

DEPARTMENT OF CIVIL 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	-	3	40	60	4
2	22PYC05	Mechanics and Materials Science	3	-	-	3	40	60	3
3	22CEC01N	Engineering Mechanics	3	1	-	3	40	60	4
4	22EGC01N	English	2	-	-	3	40	60	2
PRACTICAL									
5	22PYC08	Mechanics and Materials Science Lab	-	-	3	3	50	50	1.5
6	22EGC02N	English lab	-	-	2	3	50	50	1
7	22MEC01N	Engineering Graphics	-	1	3	3	50	50	2.5
8	22MEC38N	Digital Fabrication Workshop	-	-	3	3	50	50	1.5
TOTAL			**11**	**3**	**11**	--	**360**	**440**	**19.5**
Clock hours per week: 25									

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

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

22MTC05

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS (CIVIL)

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

Course Objectives: To enable the students

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

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

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

CO-PO Articulation Matrix

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Text Books:

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

Suggested Reading:

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

22PYC05

MECHANICS AND MATERIALS SCIENCE
(Civil & Mechanical)

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

Course Objectives: The objectives of the course is to make the student

1. Acquire knowledge about physics of oscillations and rotational motion
2. Understand the physical properties of crystalline and magnetic materials
3. Aware of characteristic properties of dielectric materials and superconductors
4. Familiarize with coherent properties of light waves.

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

1. Compare the various types of oscillations
2. Demonstrate rotational motion of rigid body
3. Classify different types of crystals and their imperfections
4. Identify magnetic and dielectric materials for engineering applications
5. Make use of lasers and superconductors in technological applications

CO-PO Articulation Matrix

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

UNIT-I

Oscillations: Simple harmonic motion–Harmonic oscillator–Damped harmonic motion – over damped, critically damped and under damped oscillators–Forced oscillations and resonance.

UNIT-II

Rigid body Dynamics: Definition of rigid body–Rotational kinematic relations–Angular momentum and torque–Equation of motion for a rotating rigid body–Inertia tensor and its properties– Euler's equations and applications: law of energy conservation and law of conservation of angular momentum.

UNIT-III

Crystallography: Space lattice –Unit cell –Crystal systems –Bravais lattices –Number of atoms per unit cell – Coordination number –Atomic radius –Packing fraction (for *sc, bcc, fcc*) –Lattice planes – Miller indices – Bragg's law –Experimental determination of lattice constant of a cubic crystal by powder X-ray diffraction method–Structure of NaCl.

Crystal Imperfections: Classification of defects –Point defects –Concentration of Schottky and Frenkel defects.

UNIT-IV

Dielectric Materials: Introduction –Dielectric polarization –Types of dielectric polarization: electronic & ionic polarizations (quantitative); orientation & space-charge polarizations (qualitative) –Frequency and temperature dependence of dielectric polarization –Determination of dielectric constant (Schering bridge method) –Ferroelectricity–Barium titanate–Applications of ferroelectrics.

Magnetic Materials: Origin of magnetism – Magnetic moment - Bohr magneton–Classification of magnetic materials: dia, para, ferro, anti-ferro and ferr imagnetic materials – Weiss molecular field theory – Domain theory –Hysteresis curve, soft and hard magnetic materials –Applications.

UNIT-V

Lasers: Characteristics of lasers – Einstein's coefficients – Amplification of light by population inversion - Ruby**,** He-Ne, 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

Superconductors: General properties of superconductors – Meissner's effect – Type I and Type II superconductors – BCS theory (qualitative) – Applications.

TEXT BOOKS:

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

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications 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.

22CE C01N

ENGINEERING MECHANICS

Instruction	3L+ 1T Hours Per Week
Duration of Semester End Examination	3 Hours
Semester End Examination (SEE)	60 Marks
Continuous Internal Evaluation (CIE)	40 Marks
Credits	4

COURSE OBJECTIVES: To enable the students 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.

Course Outcomes:

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

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

CO-PO Articulation Matrix

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 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 Pappu's & its applications. Center of gravity of elementary and composite bodies.3

UNIT- V:

Moment of Inertia: Definition of Moment of Inertia, Area Moment of Inertia, Polar Moment of Inertia, Radius of gyration, Transfer theorem, Moment of Inertia of elementary & composite areas.

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. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
2. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
3. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010.

E Resources:

1. https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://archive.nptel.ac.in/courses/112/106/112106180/

22EGC01N

ENGLISH

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

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

Prerequisite: Basic knowledge of English grammar and vocabulary.

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

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

Course Outcomes:

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

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

CO-PO Articulation Matrix

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	2	3	3	2	3	-	-	-
CO2	1	1	1	1	1	1	1	1	1	2	1	3	-	-	-
CO3	1	2	1	1	-	1	1	1	1	3	1	3	-	-	-
CO4	1	2	1	1	-	1	1	2	2	2	2	3	-	-	-
CO5	1	2	1	2	1	2	2	2	3	3	2	3	-	-	-

UNIT-I Communication Skills:

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

Vocabulary & Grammar: The concept of Word Formation - Root words, Use of prefixes and suffixes to form derivatives, Standard abbreviations. Basic Sentences.

Reading Task I.

UNIT-II Reading Skills:

The Reading process, purpose, different kinds of texts; Reading Comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Practice in Critical Reading passages.

Vocabulary and Grammar: Determiners. Use of Synonyms and Antonyms, Construction of Sentences.
Reading Task II.

UNIT-III Writing Skills II:
Paragraph Writing. – Structure and features of a paragraph; Essay writing, Cohesion and coherence. Techniques of writing précis.

Vocabulary & Grammar: Use of connectors and linkers, Tenses, Punctuation.
Reading Task III.

UNIT-IV Professional Writing Skills-1:
Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails, Email and Mobile etiquette.

Vocabulary and Grammar: Phrasal verbs, Misplaced modifiers, Subject-verb agreement.
Reading Task IV

UNIT-V Professional Writing Skills-2:
Report writing – Importance, structure, elements & style of formal reports; Writing a formal report. Writing for Blogs.

Vocabulary and Grammar: Words often Confused, Common Errors. Avoiding Ambiguity & Redundancy.
Reading Task V.

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

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

22PYC08

MECHANICS AND MATERIALS SCIENCE LABORATORY
(Civil & Mechanical)

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

Course Objectives: The objectives of the course are to make the student

1. Apply the concepts of physics while doing experiments
2. Learn the working of lasers and optical fibers
3. Understand the properties of magnetic and dielectric materials
4. Capable of measuring mechanical properties of solids and liquids
5. Understand the motion electrons in electric and magnetic fields

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

1. Estimate the error in an experimental measurement
2. Make use of lasers and optical fibers in engineering applications
3. Recall the physical properties of dielectrics and magnetic materials
4. Find the mechanical properties of solids and viscosity of liquids
5. Demonstrate the motion of electrons in electric and magnetic fields

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Flywheel	:	Determination of moment of inertia of given flywheel
3.	Compound Pendulum	:	Determination of acceleration due to gravity
4.	Young's Modulus	:	Determination of Young's modulus of the given steel bar/wooden scale by non-uniform bending method
5.	Helmholtz's Resonator	:	Determination of resonating volume of air and neck correction
6.	Melde's Experiment -	:	Determination of frequency of the electrically maintained vibrating bar/fork
7.	Viscosity of Liquid	:	Determination of viscosity of a given liquid by oscillating disc method
8.	Coupled Oscillator	:	To determine the coupling constant of a coupled oscillator performing parallel and antiparallel oscillation
9.	Dielectric Constant	:	Determination of dielectric constant of given PZT sample
10.	M & H Values	:	Determination of magnetic moment M of a bar magnet and absolute value H of horizontal component of earth's magnetic field
11.	B-H Curve	:	Determination of hysteresis loss of given specimen
12.	Thermoelectric Power	:	Determination of thermoelectric power of given sample
13.	Laser	:	Determination of wavelength of given semiconductor laser
14.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
15.	e/m of an electron	:	Determination of specific charge of an electron by J.J. Thomson method

NOTE: A minimum of TWLVE experiments should be done.

22EGC02N

ENGLISH LAB

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

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

Prerequisite: Basic Knowledge of English Communication.

Course Objectives: This course will introduce the students

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

Course Outcomes:

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

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

CO-PO Articulation Matrix

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	1	2	1	3	-	-	-
CO2	-	-	-	-	-	1	-	1	2	2	1	3	-	-	-
CO3	-	-	-	-	-	1	1	1	2	1	1	2	-	-	-
CO4	1	1	1	1	1	1	2	2	3	3	1	3	-	-	-
CO5	-	1	1	1	1	2	2	2	3	3	2	3	-	-	-

Exercises

Computer-Aided Language Learning Lab

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

Interactive Communication Skills Lab

1. **JAM-** Ice Breaking, Speaking Activity**.**
2. **Role play/Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
3. **Group Discussions -** Dynamics of a Group Discussion, Group Discussion Techniques, on-Verbal Communication.

4. **Read and Review** - Preparation for active reading and instructing the students to cultivate effective reading habits to read select texts, review and write their responses.
5. **Poster presentation –** Theme, poster preparation, team work and presentation.

Text Books:

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

Suggested Reading:

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

Suggested Software:

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

22MEC01N

ENGINEERING GRAPHICS

Instruction	1T + 3D Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2.5

Prerequisite: Nil

Course Objectives: This course aims to

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

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

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

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	2	-	1	2	3	1	3	2	1	2
CO2	3	2	2	1	2	2	-	1	2	2	1	2	2	-	2
CO3	3	3	2	1	2	2	-	1	2	2	1	2	2	-	2
CO4	3	3	3	2	2	2	-	1	2	2	1	2	2	1	2
CO5	3	2	2	1	2	2	-	1	2	2	1	2	2	2	2

LIST OF EXERCISES:

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

Text Books:

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

Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.

22MEC38N

DIGITAL FABRICATION WORKSHOP

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

Prerequisite: Nil

Course Objectives: This course aims to:

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

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

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

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	-	-	1	-	-	-	1	-	-	1
CO2	1	-	1	-	-	-	-	-	-	-	-	1	-	2	1
CO3	1	-	1	-	-	1	-	-	-	-	-	1	2	2	1
CO4	1	-	1	-	-	1	-	-	-	-	-	1	2	2	1
CO5	2	2	2	1	3	1	-	1	1	2	-	2	3	3	3

Lab Experiments

Group 1: Workshop Practice

1. To make a lap joint on the given wooden piece according to the given dimensions
2. To make a dovetail joint on the given wooden piece according to the given dimensions.
   a) Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single 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.
3. Stair case wiring Wiring of one light point controlled from two different places independently using two 2way switches.
4. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings, and bends.
5. To connect the GI pipes as per the given diagram using, Coupling, Unions, reducers, and bends. To connect the GI pipes as per the given diagram using shower, tap, and valves and demonstrate by giving water connection.

Group 2: Additive Manufacturing /3D Printing

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

Text Books:

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

Suggested Reading:

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2024-25

BE (Civil Engineering)

SEMESTER – III:

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
	THEORY								
1	22MTC10	Partial Differential Equations and Statistics	3	1	-	3	40	60	4
2	22CE C03	Surveying-I	3	-	-	3	40	60	3
3	22CE C04	Solid Mechanics	3	-	-	3	40	60	3
4	22CE C05	Fluid Mechanics	3	-	-	3	40	60	3
5	22CE C06N	Building Materials and Construction Practices	3	-	-	3	40	60	3
6	22EEM01	Universal Human Values – II: Understanding Harmony	-	1	-	-	50	-	1
7	22CE C07	Computer Aided Drafting Lab	-	-	2	3	50	50	1
8	22CE C08	Fluid Mechanics Lab	-	-	2	3	50	50	1
9	22CE I01	MOOCs/Training/ Internship	3-4 weeks/ 90 hours				50	-	2
Total			**15**	**2**	**4**	**--**	**400**	**400**	**21**
Clock hours per week: 21									

L: Lecture **T: Tutorial** **P: Practical/Drawing/Seminar/Project**

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

22MTC10

PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS

(For CIVIL/MECH/CHEM)

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

Course Objectives:

1. To explain the expansion of functions in sine and cosine series.
2. To form PDE and to find its solution.
3. To know the model of wave and heat equations.
4. Able to analyze random phenomenon using basic probability.
5. To learn fitting of distribution and predicting the future values.

Course Outcomes: On successful completion of this course the students shall be able to

1. Calculate the Euler's coefficients for Fourier series expansion of a function.
2. Solve Linear and Non-Linear PDE's.
3. Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
4. Use the basic probability for fitting the Random phenomenon.
5. Analyze the random fluctuations of probability distribution and Principles of Least Squares approximations for the given data.

CO-PO Articulation Matrix

O / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	1	1	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	1	1
CO3	2	2	2	2	-	-	-	-	-	-	-	1	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1	1	1
CO5	2	2	2	1	-	-	-	-	-	-	-	1	1	1

UNIT-I: Fourier series

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

UNIT-II: 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 Charpits Method.

UNIT-III: Applications of Partial Differential Equations

Solution by Method of Separation of Variables, Solution of One-dimensional Wave equation, Solution of One-dimensional Heat equation, Solution of Two-dimensional Laplace equation and its related problems.

UNIT-IV: Basic probability

Basic probability, Conditional probability, Baye's theorem. Random variable, Discrete probability distribution and Continuous probability distribution. Expectation, Addition and Multiplication theorem of expectation, properties of variance, Moments (Moments about the mean and moments about a point)

UNIT-V: Probability Distributions and Curve Fitting

Poisson distribution, MGF and Cumulants of the Poisson distribution, Normal distribution, Characteristics of Normal distribution, MGF and CGF of Normal distribution, Areas under normal curve. Correlation, Coefficient of Correlation and Lines of Regression. Curve fitting by the Method of Least Squares, Fitting of Straight lines, Second degree parabola and exponential curves.

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. S. J. Farlow, “Partial Differential Equations for Scientists and Engineers”, Dover Publications, 1993.
3. Sheldon Ross, “A First Course in Probability”, 9th Edition, Pearson publications, 2014.

22CE C03

SURVEYING I

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

Course Objectives: To enable the student

1. To understand basic concepts of surveying and use of chains for developing the map of a given area
2. To perform levelling operations and developing contour maps
3. To know the concepts and use of Tacheometry technique in surveying
4. To give exposure to the latest instruments like Total Station and GPS for solving the surveying problems
5. To understand the importance of trigonometric levelling and applying the same for finding the elevations of objects by various methods.

Course Outcomes:

1. At the end of the course the student should have learnt
2. To select basic surveying instruments such as chains, tapes etc., to measure areas.
3. To apply the principles of levelling and prepare contour maps to estimate volumes of earthwork using Simpsons and/or trapezoidal rules.
4. To apply the principles of tacheometry on the field.
5. To operate modern instruments like Total Station and GPS in the field
6. To make use of principles of trigonometric levelling for measuring elevations of required objects

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	1	-	-	-	-	-	-	2	3	1
CO2	2	3	-	-	-	1	-	-	-	-	-	-	2	3	1
CO3	2	3	-	-	-	1	-	-	-	-	-	-	2	3	1
CO4	2	3	-	-	-	1	-	-	-	-	-	-	2	3	1
CO5	2	3	-	-	-	1	-	-	-	-	-	-	2	3	1

UNIT- I: Introduction and Basic Principles of Surveying

Concepts of surveying, principles of surveying, various classifications of surveying. Chain survey- Concepts of survey lines, offsets. Errors in chain survey. Measurement of area - Simpson's method, average ordinate, mid ordinate and trapezoidal rules. Basics of compass survey and plane table survey- accessories and methods.

UNIT – II: Levelling and Contours

Definition of levelling, terms used in levelling. Instruments of levelling, methods of booking levels, Height of Instrument and Rise and Fall methods. Concepts of balancing levels. Types of levelling, reciprocal levelling, profile levelling, precise levelling. Correction to refraction, errors in levelling. Definition of contours- Characteristics of contours, contour interval, methods of contouring-direct and indirect. Development and use of contour maps.

UNIT – III: Tacheometry

Tacheometry - Theory and use of stadia wires in levelling instruments and theodolite. Fixed hair tacheometers, and concepts and use of Tangential tacheometry. Concepts of Reduction Diagrams, tacheometric, tables, Principle and use of substance bar and concepts of Beaman's stadia arc.

UNIT – IV: Modern Surveying Instruments Total Station and GPS

Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total station-Parts of a Total Station – Accessories, Advantages and Applications, Field Procedure for total station survey, traversing by Total Station, Errors in Total Station Survey. Concepts of consecutive coordinates- Closing error adjustment and accuracy of a traverse – Gale's traverse table. Advantages of plotting

traverse by co-ordinates, solutions to omitted measurements in traverse .Global Positioning: Systems- Segments, GPS measurements, errors and biases, surveying with GPS, co-ordinate transformation, accuracy considerations.

UNIT – V: Trigonometric Levelling

Trigonometrical levelling – Calculation of elevations and distances of accessible and inaccessible objects, numerical problems. Geodetic observations-refraction and curvature. Corrections, axis signal correction, determination of difference in elevation by single and reciprocal observations, numerical problems.

Text Books:

1. C. Venkataramaiah, "A Textbook of Surveying", Universities Press, Hyd, 2011.
2. R. Subramanian,''*Surveying and Levelling*", Oxford Higher Education, 2012.
3. B.C. Punmia & Ashok Jain, "Surveying", Vol II, 12th edition, Laxmi Publication, 2010.

Suggested Reading

1. AM. Chandra, "Plane Surveying", New Age International", 2007.
2. Arora, K.R," Surveying Vol II & III", Standard Book House & SBH Publishers & Distributors,1705, A Nai Sarak, New Delhi - 110 006, 12th edition, 2013.
3. S. K. Duggal, "Surveying", Tata McGraw-Hill Education Private Ltd, New Delhi India, 2013.

22CE C04

SOLID MECHANICS

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

Course Objectives: To enable the student

1. Understand the stress - strain behavior of different materials and temperature stresses, in compression and tension.
2. Analyze the statically determinate beams and sketch shear force and bending moment diagrams.
3. Understand the bending and shear stresses across various cross sections of beams.
4. Comprehend compound stresses, direct and bending stresses.
5. Analyze thin and thick cylinders for fluid pressures.

Course Outcomes: At the end of the course the students are able to

1. Evaluate the strength of various materials, against structural actions such as compression, tension.
2. To analyze statically determinate beams and sketch SFD and BMD.
3. Able to draw variation of shear and bending stresses.
4. Able to evaluate direct and bending stresses, compound stresses.
5. To design thin and thick cylinders for resisting internal and external pressures.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	1

UNIT- I:

Simple Stresses and Strains: Various types of stresses and strains. Hooke's law, Modulus of Elasticity, Stress-Strain curve for ductile & brittle materials, Working stress and factor of safety. Deformation of bars of uniform, varying and tapering sections under axial loads, Elongation of bars due to self-weight, Compound bars and temperature stresses.

Elastic Constants: Poisson's ratio, volumetric strain and derivation of relationship between elastic constants.

UNIT- II:

Shear force and Bending moment: Different types of beams and loads, Shear force and bending moment diagrams for cantilever, and simply supported beams with and without over hangs subjected to different kinds of loads point loads, uniformly distributed loads, uniformly varying loads and couples- Relation between loading, shear force and bending moments.

UNIT- III:

Bending stresses in Beams: Assumptions in theory of simple bending- Derivation of bending equation, Moment of resistance -Calculation of stresses in statically determinate beams for different cross sections and types of loads.

Shear stresses in Beams: Equation of shear stress, shear stress distribution across rectangular, circular, triangular, I, T, and diamond sections.

UNIT- IV:

Direct and bending stresses: Basic concept, Eccentric loading, limit of eccentricity - core of sections-rectangular, circular, solid and hollow sections.

Compound Stresses and Strains: Stresses on oblique planes, principal plane and principal stresses. Mohr's circle of stress.

UNIT- V:

Thin cylinders: Thin cylinders subjected to internal fluid pressure, volumetric change, Wire winding of thin cylinders.

Thick cylinders: Lame's equations, stresses under internal and external fluid pressures.

Text Books:

1. B. C. Punmia," *Mechanics of Materials Vol. I &II"*, Laxmi publishers, Delhi, 2017.
2. S. Ramamrutham, "*Strength of Materials*", Dhanpat Rai & Sons, Delhi, 2014.

22CE C05

FLUID MECHANICS

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

Course Objectives: To enable the students

1. To understand fluid properties, fluid pressure and forces, basic concepts and continuity equation
2. To understand the fluid motion, energy equation, analyze the forces on various objects.
3. To know various measuring instruments in finding the fluid pressure, velocity, and discharge.
4. To understand and analyze different flow characteristics of laminar and turbulent flows
5. To understand water hammer effect in pipes and to understand dimensional analysis and models studies.

Course Outcomes: At the end of the course the students are able to

1. To evaluate the various properties of fluid, analyze fluid flow and forces.
2. To apply the various laws and principles governing fluid flow to practical problems.
3. To measure pressure, velocity and discharge of fluid flow in pipes, channels, and tanks.
4. To apply laws related to laminar and turbulent flow in pipes.
5. To evaluate water hammer effect in pipes and to apply dimensional and model laws to fluid flow applications.

CO-PO Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	2	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	2	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	2	-	1

UNIT-I

Fluid Properties: Definition of fluid, Properties of fluids- Density, Specific Weight, Specific Volume, Specific Gravity, Bulk Modulus, Vapour Pressure, Viscosity, Capillarity and Surface tension, Newton's law of Viscosity.

Fluid Statics: Pascal's Law, Hydrostatic Law, Absolute and gauge pressure. Forces on immersed bodies: Total pressure, centre of pressure, pressure on curved surface.

Buoyancy: Buoyancy, Metacentre, stability of submerged and floating bodies**.**

Fluid Kinematics: Classification of fluid flow- steady unsteady, uniform, non-uniform-, one-, two- and three-dimensional flows. Concept of streamline, stream tube, path line and streak line.

Law of mass conservation – continuity equation from control volume and system analysis. Rotational and Irrotational flows, Stream function, Velocity potential function, flownet.

UNIT-II

Fluid Dynamics: Convective and local acceleration, body forces and surface forces, Euler's equation of motion from control volume and system analysis.

Law of Energy Conservation: Bernoulli's equation from integration of the Euler's equation. Signification of the Bernoulli's equation, its limitations, modifications and application to real fluid flows.

Impulse Momentum Equation: Momentum and energy Correction factor. Application of the impulse momentum equation to evaluate forces on nozzles and bends. Pressure on curved surface- vortex flow- forced and free vortex.

UNIT-III
Measurement of Pressure: Piezometer and Manometers - Bourdon Gauge.

Measurement of Velocity: Pitot tube and Current meter.

Measurement of Discharge in pipes and tanks: Venturi-meter, Orifice-meter, nozzle meter, elbow meter and rotameter. Flow through mouthpiece and orifice.

Measure of Discharge in Free surface flows: Notches and weirs.

UNIT-IV
Flow through Pressure Conduits: Reynold's Experiment and its significance. Upper and Lower Critical Reynold's numbers, Critical velocity. Hydraulic gradient. Laminar flow through circular pipes. Hagen Poiseuille equation. Turbulent flow characteristics. Head loss through pipes. Darcy-Weisbach equation. Friction factor. Moody's diagram. Minor loss, Pipes in Series and Pipes in parallel.

UNIT-V
Unsteady Flow in Pipes: Water hammer phenomenon, pressure rise due to gradual and sudden valve closure, critical period of the pipeline, power transmission through pipes.

Dimensional Analysis and Models Studies: Dimensional analysis - Rayleigh Method, Buckingham method, geometric, kinematic and dynamic similarity, similarity laws, significance of Reynolds and Froude model law, different types of models and their scale ratios, distorted and undistorted models, scale effect in models.

Text Books:
1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics Including Hydraulic Machines, Standard Book House, Delhi, 22nd Edition, 2019.
2. A.K. Jain, Fluid Mechanics including Hydraulic Machines By A.K. Jain Khanna Publishers, Delhi, First Reprint, 2016.

Suggested Books:
1 K.L. Kumar, Engineering Fluid Mechanics, Eurasia Publishing House, 2008.
2 R.K. Rajput, Fluid Mechanics and Hydraulic Machines, S. Chand and Company, 2017.

22CE C06N

BUILDING MATERIALS AND CONSTRUCTION PRACTICES

Instruction	3L Hours Per Week
Duration of Semester End Examination	3 Hours
Semester End Examination (SEE)	60 Marks
Continuous Internal Evaluation (CIE)	40 Marks
Credits	3

Course Objectives: To enable the student

1. To study about traditional building materials.
2. To study about new/composite building materials.
3. To understand the concepts of building planning and various practices adopted
4. To understand different types of roofs, doors, windows and stairs.
5. To understand different types of masonry adopted in construction sites.

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

1. Outline the applications of traditional building materials.
2. Illustrate the needs and usage of contemporary building materials.
3. Understand the concepts of building planning and various practices adopted
4. Differentiate the types of roofs, doors, windows, stairs and their applications.
5. Review the types of masonry adopted in construction sites.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	2	-	-	-	-	1	2	-	3
CO2	2	1	-	-	-	1	2	-	-	-	-	1	2	-	3
CO3	2	1	-	-	-	1	2	-	-	-	-	1	2	-	3
CO4	2	1	-	-	-	1	2	-	-	-	-	1	2	-	3
CO5	2	1	-	-	-	1	2	-	-	-	-	1	2	-	3

UNIT- I:

Introduction: Components of a building and various steps in construction of a residential building.

Building Materials:

Cement: history of cement, manufacture process of portland cement (Wet & Dry), grades of cement.

Sand: classification of sand, sources of sand, characteristics of good sand, Mortar: Functions of mortar, classification of mortars.

Aggregates: Classification of aggregates, good qualities of an ideal aggregate.

Steel: Types of steel used in building construction, types of steel reinforcement bars, uses of steel in building construction, commonly used structural steel sections and types of structural steel.

UNIT- II:

Introduction to New Materials / Composites:

Tiles: Characteristics of tiles, types of tiles used in building construction.

Autoclaved Aerated Concrete (AAC) Blocks: Composition and raw materials used in AAC blocks, advantages and disadvantages of AAC blocks.

Cellular Light Weight Concrete (CLC) Blocks: Constituents and properties of CLC blocks, advantages and disadvantages of CLC blocks.

Smart and eco-friendly materials: Introduction, benefits of smart building materials and typical smart materials using in building construction, uses and advantages of smart building materials.
Sustainable materials: Introduction, Characteristics of sustainable materials, types of sustainable materials used in building construction.

Recycled material: Reusable building materials and their advantages.

UNIT- III:
Concepts of Building Planning: Types of buildings as per national building code, functional needs and difference in their planning requirement, principles of planning, building byelaws, planning of a building with byelaws.

UNIT- IV:
Masonry Construction: Introduction

Stone Masonry: Elevation, sectional plans and cross sections of walls of Ashlar, CRS I and II sort and RR stone masonry.

Brick Masonry: Plan and isometric view of external main wall junctions, stretcher bond, header bond, English bond and Flemish bond – for half brick, one and one and a half brick wall.

Composite Masonry: Stone composite masonry, brick stone composite masonry, cement concrete masonry, hollow clay tile masonry, reinforced brick masonry.

UNIT- V:
Plumbing Services: Types of plumbing services, heating, ventilation and air conditioning (HVAC) services, formwork and shuttering, plastering and pointing. Types of roofs, doors, windows and staircases, representation of building materials and plumbing services.

Text Books:

1. S.P. Arora & S. P. Bindra, "A text book of Building Construction", Dhanpat Rai Publications, 2010.
2. A.M Neville., "Properties of Concrete", Pearson Education. 2012.

Suggested Reading:

1. P.C. Varghese, "Building construction" PHI, 2016.
2. CBRI Roorkee, "Advances in Building Materials and construction". Sushil Kumar, "Building Construction", Standard Publishers, 1992.
3. National Building Code of India, 2016.

E Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102088/
2. https://archive.nptel.ac.in/courses/105/106/105106206/

22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

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

Instruction	1 Tutorial Hour per Week
CIE	50 Marks
Credits	1

Introduction

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

Course Objectives: Student is able to

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

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

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

CO-PO Articulation Matrix

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	-	1	-	-	1	-	-	1	1	1
CO2	-	-	1	-	-	1	1	-	1	-	1	1	-	1
CO3	--	-	-	-	-	1	-	-	-	1	-	-	-	1
CO4	-	-	-	-	-	1	1	1	-	-	-	-	1	1
CO5	-	-	-	-	-	1	1	1	-	-	-	-	1	1

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

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration.
- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfill 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 fulfillment 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 individuals: 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 fulfillment among the four orders of nature - recyclability and self-regulation in nature.
- Understanding Existence as Coexistence 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 practicals 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**

22CE C07

COMPUTER AIDED DRAFTING LAB

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

Course Objectives: Using the basic tools of AutoCAD

1. Practice different Brick bonds.
2. Apply the AutoCAD tools to create building plans, sections and elevations from a given line drawing and specifications.
3. Draw different components of Doors and Windows.
4. Generate the structural drawings of structural elements.

Course Outcomes: At the end of the course, using the basic tools of AutoCAD - the student is be able to

1. Create basic 2D geometry shapes.
2. Draft elevation and sections of doors and windows.
3. Develop plan, section and elevations of buildings.
4. Draft plan and section of a staircase.
5. Draft RCC detailing of beams and footings.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	2	-	-	-	-	-	-	1	1	-	1
CO3	1	-	-	-	2	-	-	-	-	-	-	1	1	-	1
CO4	1	-	-	-	2	-	-	-	-	-	-	1	1	-	1
CO5	1	-	-	-	2	-	-	-	-	-	-	1	1	-	1

Introduction to Computer Aided Drafting - features and environment, initial settings. Coordinates - absolute, relative cartesian and polar coordinates. Snap, object snap, grid, ortho and polar modes. Draw tools and editing tools. Zoom and pan. Creating and managing – text and Dimensions. Managing object properties and hatching. Creating and inserting blocks, working in view ports and Layers.

List of Experiments:

1. Creating basic 2D geometry shapes.
2. Drafting elevation and sections of windows
3. Drafting elevation and sections of doors.
4. Developing plan, section and elevation of a single room house.
5. Developing plan, section and elevation of a single bedroom house.
6. Drafting the plan and section of a staircase (without reinforcement).
7. Detailing of RCC beam and footing.
8. Interpretation of Civil Engineering Drawings.
9. Guest lecture on – digitization of Industrial legacy drawings.

Text Books:

1. S.P Arora and S.P Bindra, ‘A text book of Building Construction’, Dhanpat Rai & sons, 2010.
2. George Omura, Brian C. Benton, ‘Mastering AutoCAD 2019 and AutoCAD LT 2019’, Wiley, 2018.

Suggested Reading:

1. K.Veenugopal, ‘Engineering Drawing and Graphics + Autocad’, New Age International Pvt.Ltd, 2010.
2. Balagopal A and Prabhu T. S, ‘Building Drawing and Detailing’, Spades publishers, Calicut, 1987.

22CEC08

FLUID MECHANICS LAB

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

Course Objectives:

1. To understand the governing parameters for the discharge measurement for flows through various measuring devices.
2. To determine the Reynold's number to understand laminar and turbulent flow.
3. To understand Bernoulli's principle through experiment.
4. To determine Hydrostatic forces on flat and curved surfaces by conducting experiments.
5. To understand stability of floating bodies by conducting experiments.
6. To understand the viscosity of different fluid.

Course Outcomes: At the end of the course, the students can able to

1. Compute the co-efficient of discharge for flows through various flow measuring devices.
2. Differentiate between laminar and turbulent flows in Reynold's experiment and identify the governing parameters for both.
3. Apply the Bernoulli's energy principle in real field cases.
4. Apply the concept of hydrostatic forces on flat and curved surfaces.
5. Compute the centre of buoyancy, stability and metacentre of floating body.
6. Differentiate between viscous and non-viscous flows and identify the governing parameters for both.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	1	-	-	-	1	2	1
CO2	3	1	-	-	-	-	-	-	1	-	-	-	1	2	1
CO3	3	1	-	-	-	-	-	-	1	-	-	-	1	2	1
CO4	3	1	1	-	-	-	-	-	1	-	-	-	1	2	1
CO5	3	1	1	-	-	-	-	-	1	-	-	-	1	2	1

LIST OF EXPERIMENTS

1. Determination of Cd, Cv, and Cc for circular Orifice (constant Head method).
2. Determination of Cd for mouthpiece (Falling Head method).
3. Determination of Cd for V notch.
4. Determination of minor losses and major loss in pipes.
5. Determination of Cd for venturi meter and orifice meter.
6. Determination of types of flow using Reynold's apparatus.
7. Verification of Bernoulli's principle.
8. Measurement of viscosity.
9. Stability of Floating Body.
10. Hydrostatics Force on Flat Surfaces/Curved Surfaces.

Text Books:

1. M.N. SheshaPrakash, "Experiments in Hydraulics and Hydraulic Machines – Theory and Procedures", PHI Learning Private Limited, 2011.
2. R.V.Raikar, "Laboratory Manual Hydraulics and Hydraulic Machines-PHI Learning Private Limited,2012.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2023-24

BE (Civil Engineering)

SEMESTER – IV:

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
	THEORY								
1	22CE C09	Hydraulic Engineering	3	-	-	3	40	60	3
2	22CE C10	Surveying - II	3	-	-	3	40	60	3
3	22CE C11	Structural Analysis -I	3	-	-	3	40	60	3
4	22CE C12	Reinforced Concrete Design - I	3	-	-	3	40	60	3
5	22CE C13	Concrete Technology	3	-	-	3	40	60	3
6	-	PE-1	3	-	-	3	40	60	3
7	22CE C14	Hydraulic Engineering Lab	-	-	3	3	50	50	1.5
8	22CE C15	Surveying & Geomatics Lab	-	-	3	3	50	50	1.5
9	22CE C16	Solid Mechanics Lab	-	-	3	3	50	50	1.5
10	22EG M01	Indian Constitution & Fundamental Principles	2	-	-	2	-	50	NC
11	22CE U01	Upskilling Certification Course-I	-	-	-	-	25	-	0.5
Total			**20**	**-**	**9**	**-**	**415**	**560**	**23**
Clock hours per week: 29									

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

Professional Elective-1 (PE-1)

Subject code	Subject Name
22CE E01	Green Building Technologies
22CE E02	Principles of Geographical Information Systems
22CE E03	Ground Water Engineering
22CE E04	Applications of Data Analytics in Civil Engineering

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22CE C09

HYDRAULIC ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objective of this course is to

1. Understand and analyze the open channel flows, steady uniform flow and computation of friction and energy losses.
2. Understand and analyze the non-uniform flows and flow profile, energy dissipation
3. Exposure to the basic principles of aerodynamic forces, boundary layer formation and effects.
4. Understand the turbines; design the impulse turbine and its performance.
5. Familiarize with reaction turbines and its design, understand performance of reaction turbines and centrifugal pump

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

1. Apply the concepts of open channel flow and design the efficient channel cross section.
2. Apply the concepts of non-uniform open channel flow to the field problems.
3. Interpret the basics of computation of drag and lift forces in the field of aerodynamics, boundary layer effect.
4. Design the impulse turbines, run the turbines under efficient conditions.
5. Design the reaction turbines, draw characteristic curves of turbines and centrifugal pump.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	2	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	2	1
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1

UNIT–I:

Uniform Flow Through Open Channels: Introduction, Difference in pipe flow and open channel flow, classification of flow in channels, velocity and pressure distributions in channel cross-sections, energy and momentum correction coefficients, discharge through open channel by Chezy's and Manning's formula, most economical section of channels-rectangular, trapezoidal, circular and triangular channel sections, concept of critical depth and its computations, Significance of Froude number, specific energy and specific force.

UNIT–II:

Non-Uniform Flow through Open Channels:

Gradually Varied Flow: Dynamic equation of gradually varied flow, classification of channel bottom slopes and water surface profiles, back water curve and afflux, expression for length of back water curve-Direct step method.

Rapidly Varied flow: Hydraulic jump, conjugate depths, Expression for depth and length of hydraulic jump, loss of energy, introduction to surges.

UNIT–III:

Boundary Layer Theory: Introduction, development of Boundary layer on the thin flat plate, laminar and turbulent boundary layers, laminar sub layer, boundary layer thickness- displacement thickness, momentum thickness and energy thickness, hydro-dynamically smooth and rough boundaries. Effect of pressure gradient on boundary layer separation, location of separation point, methods of preventing the separation of boundary layer.

Drag and Lift: Fundamental concepts of drag and lift forces, co-efficient of drag and lift, principles of

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streamlinng, Magnus effect.

UNIT-IV:

Impact of Jets: force exerted by the jet of jets on stationary and moving flat, inclined and curved vanes, jet striking
centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-angular momentum principle and torque.

Hydraulic Turbines-I: Introduction, classification, head and efficiencies, unit quantities, specific speed, power developed by turbine, principles and design of impulse turbine- Pelton wheel turbine, velocity triangles, characteristic curves.

UNIT-V:

Hydraulic Turbines-II: Reaction turbine - main components and working, work done and efficiencies, Design of Francis turbine and Kaplan turbine, unit quantities, specific speed, characteristic curves, draft tube theory, cavitation: causes, effects.

Centrifugal Pumps: Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pumps.

Text Books:

1. P.N. Modiand S. M. Seth, "*Hydraulicand Fluid Mechanics*", Standard Book House, Delhi, 2013.
2. K. Subramanya, "*Flowin Open Channels*", Tata McGraw-HillEducation,2009.

Suggested Reading:

1. K. Subramanya, "*1000 Solved Problems in Fluid Mechanics*", TataMc-GrawHillPublications2005.
2. VenTeChow,"*Open-ChannelHydraulics",*McGraw-Hill,NewYork,1959.
3. K. Jain, "Fluid Mechanics: Including Hydraulic Machines", Khanna Publisher, 12th edition, 2016.
4. R. L. Streeter, G. Z. Watters, and J. K. Vennerd, "Elementary Fluid Mechanics", John Wiley International Publications, 7th Edition, 1996

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22CE C10

SURVEYING - II

Instruction	3 Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the student

1. To understand the importance of various horizontal curves and the methods of setting
2. To understand the importance of transition curves and vertical curves and the methods of setting.
3. To understand the concepts of photogrammetric surveying
4. To know the simple concepts of Remote Sensing and image processing
5. To know the basics of adjustments of errors in survey and basics of LiDAR survey.

Course Outcomes: At the end of the course, student is able

1. To execute setting of simple and compound curves on the field by overcoming obstructions in curve ranging
2. To select suitable transition curves based on real world conditions and execute it on field
3. To apply the concepts of photogrammetry for solving problems in civil engineering
4. To choose appropriate remote sensing technique for data acquisition and image processing techniques for identification of ground features accurately
5. To be able to adjust the errors that are cropping while carrying surveying and adopt LiDAR survey for acquiring topographic data at high speed.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	1	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	1	-	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT- I:

CURVE SETTING

Curves: Introduction, Designation of curves, Elements of simple curves. Setting out simple curves by angular methods-Rankine's principle. Compound curves-Elements – solutions to different cases. Reverse curves-parallel straights and non-parallel straights.

UNIT – II:

TRANSITION CURVES AND VERTICAL CURVES

Transition curves: Requirements-super elevation-equilibrium cant – cant deficiency-centrifugal ratio, length of transition curve-arbitrary gradient, the time rate, rate of change of Radial Acceleration. Ideal transition curve - Clothoid-cartesian coordinates-computations of Deflection angles. Modified ideal transition curves- The cubic Parabola, the cubic spiral, Characteristics of Transition curves and setting out of transition curves.

Vertical curves: Introduction, concepts of grade and change of grade-types of vertical curves, computations and setting of vertical curves-elevations by tangent correction, chord gradient-influence of sight distances.

UNIT – III:

PHOTOGRAMMETRIC SURVEYING

Photogrammetric Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial Photogrammetric, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes

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UNIT – IV:
REMOTE SENSING AND VISUAL IMAGE INTERPRETATION
Remote sensing: Definition, Energy Principles, radiation principles, principles and Use of EMR spectrum, Energy interactions in atmosphere- Scattering, Absorption, Energy interactions with h surface features and concepts of spectral reflectance curve. Spectral reflectors, Diffuse reflectors, spectral reflectance on –vegetation, soils, water, pavement surface, spectral response pattern-atmospheric influences, characteristics of ideal remote sensing system and applications remote sensing to civil engineering problems.

Visual Image Interpretation: Introduction, fundamentals of visual image elements, image interpretation strategies and keys, wavelength of sensing, temporal aspects of image interpretation. Introduction to types of digital image processing.

UNIT – V:
THEORY OF ERRORS AND LIDAR SURVEY
Theory of errors: Theory of errors and survey adjustments introduction, types of errors, laws of weights, Principles of Least squares, most probable value, method of displacements, Method of correlates, probable errors, distribution error. **LiDAR Survey:** Introduction to LiDAR survey and fundamental concepts.

Text Books:

1. K. R. Arora, "*Surveying, Vol-I, II and III*", Standard Book House, 2015.
2. Gopi Satheesh and R.Sathikumar, "*Advanced Surveying: Total Station, GIS and Remote Sensing*", Pearson India, 2006.
3. T. Lillesand, R. W. Kiefer, "Remote Sensing and Image Interpretation", Jhon Willey & Sons, 2015.

Suggested Reading:

1. K. Manoj K. Arora and R. C. Badjatia*," Geomatics Engineering*", Nem Chand & Bros, 2011
2. A. M. Chandra, "*Higher Surveying",* Third Edition, New Age International (P) Limited, 2002.
3. M. Anji Reddy, "*Remote sensing and Geographical information system*", B.S. Publications, 2001.

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22CE C11

STRUCTURAL ANALYSIS - I

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the students

1. Comprehend the concept of determination of flexural deflections statically determinate beams using various methods.
2. Analyze the indeterminate beams.
3. Understand the behavior of circular shafts subjected to torsion and also to the combined effect of bending and torsion.
4. Compute the strain energy in bars subjected to the action of various types of loads and significance and analysis of types of springs.
5. To compute maximum load carrying capacity of various columns.

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

1. Compute slopes and deflections in determinate beams, under various types of static loads, using a suitable method.
2. Analyze the propped cantilevers and fixed beams subjected to various types of loads.
3. Analyze and design circular shafts subjected a given torque and bending.
4. To determine the strain energy in members under various loading situations, and to analyze various types of springs.
5. Analyze various types of columns with different end conditions.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO2	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO3	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO4	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2

UNIT-I:

Slopes and Deflections: Determination of Slope and deflections by double integration method and Macaulay's Method for cantilever, simple supported beams and overhanging beams carrying point loads, uniformly distributed loads, uniformly varying loads and couples. Application of Moment area method and Conjugate beam method for determination of Slope and deflections in simple cases.

UNIT - II:

Propped Cantilevers: Analysis of propped cantilever beams with elastic and rigid props for point loads and uniformly distributed loads, and determination of slope and deflections.

Fixed beams: Analysis of fixed beams subjected to point loads, uniformly distributed loads, uniformly varying loads. Slope and deflections in fixed beams with and without sinking of supports.

UNIT - III:

Torsion: Theory of pure torsion, Torsion equation, solid and hollow circular shafts, strength and stiffness of shafts, Transmission of power. Shafts in series and Shafts in parallel. Combined torsion and bending. Equivalent Bending and Torsional Moments.

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UNIT - IV:

Strain energy: Strain energy, proof resilience and modulus of resilience. Strain energy in bars subjected to gradually applied loads, suddenly applied and impact loads. Strain energy due to shear, bending and torsion.

Springs: Types of springs and significance, analysis of Closed and open coiled helical springs under axial load and twist.

UNIT- V:

Columns and Struts: classification of columns, Euler's theory for different end conditions of columns, effective length factors, radius of gyration and slenderness ratio, limitations of Euler's theory. Empirical formulae- Rankine's - Gordon's formula, Secant and Prof. Perry's formulae.

Text Books:

1. B .C. Punmia, "*Mechanics of Materials Vol. I &II* ", Laxmi publishers, Delhi, 2011.
2. S. Ramamrutham, "*Strength of* Materials", Dhanpat Rai & Sons, Delhi, 2012.

Suggested Reading:

1. S.B. Junnarkar*," Mechanics of structures (Vol-I &Vol-II)",* Charotar Publishing house, Anand, 2002.
2. D.S. Prakash Rao, "*Strength of Materials-A Practical Approach"*, Universities Press, 1999.
3. E.P. Popov, "*Engineering Mechanics of solids*", 1993.
4. G.H. Ryder, "*Strength of Materials",* 3 Edition in SI units, Macmillan India Ltd, Delhi, 2012.
5. A. Pytel and F. L. Singer, "*Strength of Materials",* Harper & Row, 4 Editions, New york.1999.

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22CE C12

REINFORCED CONCRETE DESIGN – I

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the students to

1. Understand general mechanical behavior of reinforced concrete, design philosophies, design requirements get introduced to IS: 456 code and working stress method of design applied to RC rectangular beams.
2. Understand the basic principles of Limit state design, assumptions made in theory of flexure and flexural design procedures for singly reinforced and doubly reinforced rectangular beam.
3. Grasp the fundamentals of analysis and design of rectangular beams for shear and torsion, checking for bond and applying serviceability check for beams.
4. Know the procedures for analysis and design of one-way simply supported and cantilever slabs and two-way simply supported and continuous slabs.
5. Learn the design and detailing of columns and footings of rectangular and circular sections.

Course Outcomes: At the end of the course, student is able to

1. Use and suggest Reinforced concrete for various practical applications, interpret the clauses of IS: 456 and apply the working stress method of design for rectangular beams.
2. Design RC beams of rectangular and flanged sections/ for flexure using limit state method and check for serviceability.
3. Design RC beams for shear, torsion and bond.
4. Analyse and design solid rectangular RC slabs of one way (cantilever, simply supported and continuous) and two way (simply supported and continuous).
5. Design RC short columns for axial loads and moments and axially loaded isolated footings.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	-	-	-	-	-	3	2	1
CO2	2	2	2	1	1	-	-	-	-	-	-	-	3	2	1
CO3	2	2	2	1	1	-	-	-	-	-	-	-	3	2	1
CO4	2	2	2	1	1	-	-	-	-	-	-	-	3	2	1
CO5	2	2	2	1	1	-	-	-	-	-	-	-	3	2	1

UNIT - I: Introduction to Reinforced Cement concrete: Concept of reinforced concrete - basic requirement of RC structures-Stresses, loads & combinations- Design Philosophies: Development of design philosophies – Introduction to working stress method and Limit state method - classification of limit states – characteristic loads - partial safety factors – Factors for material and load - design stress – stress and strain diagram of concrete and steel - Merit and demerits. Introduction to IS: 456- General design requirements and specifications. Working Stress method: Assumptions made in design of flexural members –Theory of bending in RC beams - Balanced, under and over reinforced sections. Analysis and design for flexure of singly reinforced rectangular beams-Analysis and design T- beams using WSM.

UNIT- II: Limit state method of design: Assumptions made in design of flexural members - Stress block parameters - Analysis and flexural design of singly reinforced, doubly reinforced rectangular beams and singly reinforced flanged beams. Limit state of serviceability: Short term, long term, total deflection - check for deflection - cracking - IS code provisions.

UNIT - III: Limit state of collapse in shear and torsion: Types of shear reinforcement – analysis and design for shear and torsion in beams - Bond - development length and curtailment of reinforcement in beams and detailing of bars: IS code provision.

UNIT - IV: Analysis and design of slabs as per IS 456: Solid rectangular slabs – one-way slabs (cantilever,

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simply supported and continuous), two-way slabs (simply supported and continuous slabs) subjected to uniformly distributed loads - Detailing of reinforcement and check for serviceability in slabs, Design of stairs - Design and detailing of dog legged slab type staircase.

UNIT - V: Analysis and design of columns as per IS 456: Short and long columns - End conditions, effective length of columns - assumptions made in design - design and detailing of axially loaded rectangular and circular columns with lateral reinforcement - Design of axially loaded short columns subjected to uniaxial and bi-axial moments using interaction diagrams, Design of isolated footings as per IS 456: Design and detailing of axially loaded rectangular and circular footings.

Text Books:

1. N. Subramanian, "*Design of Reinforced Concrete Structures*" Oxford University Press. First Published in 2013, Second impression 2014.
2. S. Unni Krishnan Pillai and Devadas Menon, "Reinforced Concrete Design", Tata McGraw-Hill Publishing Co Ltd, (Third Edition), 2009.

Suggested Reading:

1. V. L. Shah and S. R. Karve, "Limit State Theory and Design of Reinforced Concrete", Structures Publications, 7th Edition, 2014.
2. A.K. Jain, "Reinforced Concrete: Limit State Design", Nem Chand & Brothers-Roorkee; Seventh edition, paperback – 2012.
3. Sushil Kumar, "Treasure of RCC Designs", Standard Book House; Edition: 19th, Year-2014 edition (1 December 2009).
4. N. Krishna Raju, "Design of Reinforced Concrete Structures", CBS Publishers and Distributors, New Delhi, 4th edition, 2016.

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22CE C13

CONCRETE TECHNOLOGY

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Outcomes: To enable the students to

1. Learn the properties & conduct tests on various ingredients of concrete.
2. Understand the behavior of concrete in fresh and hardened states.
3. Understand the Mix design of concrete using various design methods.
4. To learn the durability of concrete & acquire knowledge on the properties and effective usage of various admixtures.
5. Gain knowledge of various special concretes and their applications

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

1. Understand the properties of concrete making materials and production of concrete.
2. Analyze the properties of fresh and hardened concretes.
3. Design the concrete mix using various methods for a specified grade.
4. Evaluate durability of concrete and apply suitable admixtures in concrete making.
5. Evaluate and choose appropriate concrete for field application.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
CO1	2	3	-	-	-	1	-	-	-	-	-	-	2	1	3
CO2	2	3	-	-	-	1	-	-	-	-	-	-	2	1	3
CO3	2	3	-	-	-	1	-	-	-	-	-	-	2	1	3
CO4	2	3	-	-	-	1	-	-	-	-	-	-	2	1	3
CO5	2	3	-	-	-	1	-	-	-	-	-	-	2	1	3

UNIT- I:

Concrete Materials & Production of Concrete: Manufacturing process of cement, Types of cements, Properties of cement and aggregate (fine & coarse), tests conducted on cement and aggregate (fine & coarse). Production of concrete – Various methods of batching, mixing, compaction and curing. Water cement ratio, gel space ratio, Segregation and bleeding of concrete.

UNIT- II:

Fresh concrete: Workability, factors affecting workability, measurement of workability using slump cone, compaction factor.

Hardened concrete: Behavior of concrete under various types of loading - compression, Tension and flexure. Non - destructive testing methods. Time dependent behavior of concrete –Maturity, shrinkage & creep. Stress-Strain behavior of concrete.

UNIT - III:

Durability of concrete:

Durability – Factors affecting Durability, Cracking of Concrete - types of cracks, causes, remedies. Deterioration of concrete and its prevention. Behavior of concrete under various types of extreme environments, Freezing and Thawing, Acid attack on concrete, Efflorescence, fire resistance.

Concrete Admixtures:

Classification of admixtures, Mineral and Chemical admixtures, Influence of various admixtures on properties

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of concrete.

UNIT - IV:

Concrete Mix Design: Basic considerations, Factor to be considered in choice of mix design, Different mix design methods – I.S. code method and ACI methods. Quality control of Concrete**.**

UNIT- V:

Special Concretes: Properties & applications of High Strength Concrete, High Performance Concrete, Polymer Concrete, High Density Concrete, Light Weight Concrete, and Ferro cement, Recycled Aggregate Concrete, Self-Compacting Concrete (SCC) , Fly Ash Concrete,.Ready Mix Concrete (RMC), Self-healing Concrete (Bacterial Concrete).

Fiber Reinforced Concrete (FRC): Types of fibers, Constituent materials, Mechanism, Properties & Applications of Steel Fiber Reinforced Concrete , Geopolymer concrete.

Text Books:

1. A.M Neville., "Properties of Concrete", Pearson Education. 2012.
2. M.S. Shetty, and A. K. Jain, "Concrete Technology: Theory and Practice", S. Chand & Company, 2018.
3. R. Santhakumar, "Concrete Technology", Oxford University, Press 2018.

Suggested Reading:

1. A.M. Neville and J.J. Brooks, "Concrete Technology", Dorling and Kindersley Publications, 2002.
2. P. K. Mehta, and J. M. M. Paulo, "Concrete- Microstructure – properties and Material", Mc. Graw Hill Publishers, 2017.
3. N. Krishnaraju, "Design of Concrete Mixes", CBS Publishers and Distributors, 2010.

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22CE E01

GREEN BUILDING TECHNOLOGIES

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: To enable the students

1. To understand the basic principles of green building technologies and their significance.
2. To understand the judicial use of energy and its management.
3. To know about the Sun-earth relationship and its effect on climate.
4. To enhance awareness of end-use energy requirements in the society.
5. To know about the suitable technologies for energy management and audit procedures.

Course Outcomes: At the end of the course, the student should

1. Be able to identify the fundamentals of energy use and energy processes in building.
2. Be able to identify the energy requirement and its management.
3. Apply the knowledge about Sun-earth relationship vis-a-vis its effect on climate.
4. Be able to deal with the end-use energy requirements.
5. Be familiar with the audit procedures of energy.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	1	2	1	-	-	-	1	2	-	2
CO2	1	1	-	-	1	1	2	1	-	-	-	1	2	-	2
CO3	1	-	-	-	-	1	2	1	-	-	-	1	1	-	1
CO4	2	2	-	-	-	-	2	1	-	-	-	1	1	-	1
CO5	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-

UNIT- I:
Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT- II:
Indoor environmental requirement and management: Thermal comfort – Ventilation and air quality – Visual perception – Illumination requirement - Auditory requirement.

UNIT- III:
Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT- IV:
End-use, energy utilization and requirements: Lighting and day lighting - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT- V:
Energy management options: Energy audit and energy targeting – Technological options for energy management. Certification- Study of the LEED and TERI (GRIHA) parameters and certification of Green Buildings

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Text Books:

1. Charles J. Kibert*,"Sustainable Construction - Green Building Design and Delivery*", John Wiley & Sons, New York, 2008
2. Norbert Lechner,"*Heating, Cooling, Lighting - Sustainable Design Methods for Architects*", Wiley, New York, 2015.
3. James Kachadorian, "*The Passive Solar House: Using Solar Design to Heat and Cool Your Home*", Chelsea Green Publishing Co., USA, 1997.

Suggested Reading:

1. Michael Bauer, Peter Mosel and Michael Schwarz, "Green*Building – Guidebook for Sustainable Architecture",*
   *S*pringer, Heidelberg, Germany, 2010.
2. Mike Montoya,"*Green Building Fundamentals*", Pearson, USA, 2010.
   Regina Leffers*, "Sustainable Construction and Design*", Pearson / Prentice Hall, USA, 2009

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22CE E02

PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEM

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course objectives: To enable the student

1. Understand the basics and applications of GIS, and concepts of Maps , projections
2. Understands the basic difference between vector GIS and raster GIS.
3. Understand the various types of data, realize the importance of spatial data and also in a position to apply methods of data compression techniques. 4.Identify various types analysis functions used integrated analysis GIS data
4. Understand the basics of use of GIS softwares and apply the principles of cartographic modelling to watershed modeling, environmental modeling and watershed management.

Course Outcomes: At the end of the course, the student

1. Is able to apply the principles of GIS to various field problems and take decisions under uncertain conditions.
2. Is able to understand advantages and disadvantages of using vector GIS and raster GIS.
3. Is able to apply the methods of data Compression using GIS. 4. Can perform the data modeling and analysis using GIS.
4. Is able to apply the Cartographic modelling techniques for Watershed modeling, Environmental Modeling and for Watershed Management, visibility analysis.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	2	2	2	-	-	-
CO2	2	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	2	1	-	-	-	1	1	1	1	-	-	-
CO5	2	2	2	2	1	-	-	-	1	1	1	1	-	-	-

UNIT– I:

Introduction: Definition of GIS , History of development , Components of GIS-Data, Technology, System and Users, Map- introduction, scale, types of maps, mapping process-planning, data acquisition , cartographic production phase, product delivery, Plane coordinate system -rectangular, polar , Linear coordinate transformation system, Geographic coordinate system,

Map projections -Properties-area, shape, distance and direction, Classification -cylindrical, Conical, Azimuthal, Aspects of Projections-Normal, Transverse, oblique, View Points -Gnomonic, Orthographic and stereographic, Map projections for GIS, Datums-Geodetic and vertical, relationship between Coordinate system and map projections, UTM Projections

UNIT-II:

GIS Data: Nature of Geographic data-Geographic position, attributes, spatial relationship, time, Data types– spatial non spatial (attribute data)–data-structure, data format – point, line Polygon, Spatial data models - Raster data- data compression-point coding Run length coding, Quadtrees, Vector models- The spaghetti model, topological models, Triangulated irregular network model, Data files strucutre in computer – Hierarchical, Network, Relational data base , object based data models Concepts of Geo referencing, Existing digital data – cartographic database. Digital elevation data

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UNIT-III:

GIS Data analysis function : Introduction , organising Geographic data -data layers, coverage Classifications of analysis functions Spatial data analysis, data retrieval, query (SQL)–Organizing data for analysis, classification of GIS analysis function, maintenance and analysis of spatial data – transformation, conflation, Edge matching and Editing, Maintenance and analysis for non-spatial attribute data- Attribute editing and Attribute query functions.

UNIT-IV:

Integrated analysis functions: Retrieval and classification function: Overlay operations, neighborhood operations, connectivity function, output formatting – Map annotations, text pattern and line styles, graphic symbols, cartographic modeling by GIS analysis procedure with an example.

Presentation of Geo-data Analysis: Types of output data–types of errors elimination and accuracies – sampling - components of data quality.

UNIT-V:

Software scenario – Functions: Introduction of Arc GIS, QGIS sfotwares,

Cartographic modelling - concepts, applications to Watershed modeling, Watershed Management, Environmental modeling – Visibility analysis. Vehicle tracking.

Text Books:

1. C.P.LO, Albert K.W. Yeung " Concepts And Techniques of Geographic information systems" Prentice Hall of India Private Limited New Delhi,2016
2. P.A. Burrough, "*Principles of Geographical Information Systems for Land Resources Assessment (Monographs on Soil and Resources Survey)",* Oxford University Press, 1986.
3. Lillesand and Kiefer, "*Remote Sensing and Image Interpretation*", Wiley; Sixth edition, 2011.

Suggested Reading:

1. Heywood, S. Cornelius and Steve Carver, "*An Introduction to Geographical Information Systems*", Pearson, 4th Edition, 2012. 2. B. Bhatta, "*Remote Sensing and GIS*", Oxford, Second edition, 2011. 3. S. Kumar, "*Basics of Remote Sensing and GIS*", Laxmi Publications, First edition, 2016.
2. S. Aronoff, "*Geographic Information Systems: A Management Perspective*", WDL Publications Ottawa, 1991.
3. Michael N Demers ,"Fundamentals of Geographic system" Jhon Wiley sons, INC, 4th edition,2008

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22CE E03

GROUND WATER ENGINEERING

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course objectives: To enable the students to

1. Basics of groundwater hydrology, familiar with aquifer parameters.
2. Unsteady flow and its flow computation.
3. Exploring groundwater through surface and subsurface methods.
4. Artificial recharge and causes, methods of recharge.
5. Various models in groundwater, quality of groundwater, pollutant transport.

Course outcomes: The student should able to

1. Assess groundwater potential and head.
2. Estimate hydraulic conductivity and storage coefficient for time variant flow.
3. Investigate groundwater availability for a given area.
4. Plan and design artificial recharge.
5. Construct model and analyze groundwater flow.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-	1
CO3	3	2	1	-	-	1	1	-	-	-	-	-	2	-	1
CO4	3	2	1	-	-	1	1	-	-	-	-	-	2	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-	2	-	1

UNIT- I:

Introduction: Occurrence of groundwater, problems and perspectives regarding groundwater in India, groundwater basin, ground water in hydrologic cycle, vertical distribution of ground water, Hydrologic balance equation, types of aquifers. Darcy's law and limitations, aquifer parameters, specific yield, safe yield, three-dimensional groundwater flow equation, Steady radial flow to a well in unconfined and confined aquifers.

UNIT- II:

Unsteady radial flow to a well: Non equilibrium equation for pumping tests. This method of solution, Cooper Jacob method, Chow's methods of solution. Law of times, well flow near aquifer boundaries, Image well theory, multiple well systems, well losses, pumping and recuperation tests.

UNIT- III:

Geophysical Exploration:

Surface investigations: Surface investigations of ground water – electrical resistivity method, seismic refraction method, gravity and magnetic methods, geologic methods, dowsing, remote sensing.

Subsurface Investigations: Test drilling, resistivity logging, temperature logging, caliper logging, Interpretation of logs and selecting the groundwater potential zones.

Unit- IV:

Artificial Recharge of groundwater: Methods of recharge, water spreading, sewage discharge, recharge through pits and shafts, recharge through well, induced recharge.

Sea water intrusion in coastal aquifers, occurrence, Ghyben – Herzberg relation, shape of fresh – salt water interface, Length of the intruded sea water wedge. Prevention and control of sea water intrusion.

Unit-V:

Modelling techniques: Introduction, ground water models, sand models, viscous fluid models, membrane models, thermal models, electric-Analog models. Numerical modelling, finite difference method.

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Quality of groundwater: Groundwater Contamination, sources of groundwater contamination, groundwater quality criteria, advection process, diffusion and dispersion process, pollutant transport equation and modelling of pollutant transport.

Text Books:

1. D.K. Todd, "*Ground Water Hydrology*", John Wiley & Sons, Inc., USA, 2015
2. H.M. Raghunath, "*Ground Water*", Wiley Eastern Limited, New Delhi, 2007.

Suggested Reading:

1. Bouwer, "*Ground Water Hydrology*", Mc. Graw Hill, Newyork, 2013
2. A. K. Rastogi, "*Numerical Groundwater Hydrology*", Penram International Publishing, Mumbai, 2007.J. Bear, "*Hydraulics of Ground*

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22CE E04

APPLICATIONS OF DATA ANALYTICS IN CIVIL ENGINEERING

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: To enable the students to

1. Develop different mathematical models to solve the civil engineering problems
2. Categorize variables to use in decision making process
3. Design procedures to collect data on civil engineering projects
4. Identify the estimation processes for discovering patterns in civil engineering
5. Use hypothesis testing to model the civil engineering related count data

Course Outcomes: On successful completion of this course, student will be able to

1. Define the descriptive, predictive and prescriptive models and select suitable tools or techniques for application in civil engineering problems
2. Identify the discrete and continuous random variables and select appropriate mathematical models which support decision making under uncertainty
3. Design data collection process required for descriptive and exploratory models for problems in civil engineering
4. Relate estimators and estimates to process of estimation and thus implement the various modelling techniques to uncover the patterns in the civil engineering related data
5. Formulate hypothesis and their corresponding confidence intervals for various count data based and discrete choice models along with goodness of fit measures

CO PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	1	-	-	-	-	-	-	-	1	1	1
CO4	2	2	-	-	1	-	-	-	-	-	-	-	-	-	-
CO5	1	1	1	1	-	-	-	-	-	-	-	-	1	-	-

UNIT I:

Introduction: Fundamentals and the context of data analytics, descriptive, predictive and prescriptive models of data analytics, evolution of data analytics solutions such as SQL analytics, visual analytics, big data analytics, and cognitive analytics. Data analytics tools and techniques used in civil engineering.

UNIT II:

Random variables: Sample, population, sample space, frequentist and Bayesian notations of probability, discrete and continuous random variables and their distributions.

Statistical Modelling: Overview, application, desirable features, issues and pitfalls of statistical models, framework for developing models, basic steps in model building and decision making under uncertainty.

UNIT III:

Experimental and observational study design: sample selection, recruitment, and data collection method selection. Descriptive and exploratory data analysis, including: measures of central tendency, histograms, density distributions, and box plots. Examples of descriptive and exploratory analysis for civil engineering related problems.

UNIT IV:

Estimation, estimators and estimates; criteria for assessing estimators, asymptotic properties. Estimation techniques: method of moments, ordinary least squares (OLS) regression, log likelihood estimation. OLS – assumptions of linear regression, linear relationship, and estimation of coefficients. Log likelihood estimation -

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definition of likelihood and log likelihood, parameter estimation using maximum likelihood estimation technique, desirable properties of maximum likelihood estimators.

UNIT V:
Statistical inference of models including tests, confidence intervals and hypothesis testing. Statistical models of independent data including simple and multiple linear regression. Count data and discrete choice models: Binary, multinomial logit models, and count data models with applications in travel choice and transport safety. Process of model selection, goodness of fit and sensitivity analysis.

Text Books:

1. Mashrur Chowdary, Amy Apon and Kakan Dey, Data Analytics for Intelligent Transportation Systems, 2012
2. Subhashish Samaddar and Satish Nargundkar,Data Analytics: Effective methods for Presenting Results, CRC press, 2012.

Suggested Reading:

1. S.M Yadav, Application of soft computing techniques in civil engineering, 2018.
2. V.K.Jain, Data Science and Analytics, Khanna Publishing, 2018.

E Resources:

1. http://nptel.ac.in/courses/106106126/

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22CEC14

HYDRAULIC ENGINEERING LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: To enable the students

1. To understand uniform and non-uniform flows and the importance of Froude number in open channel flows.
2. To measure the discharge in venturi flume open channel.
3. To determine super elevation in a curved channel and coefficient of discharge in a hemi spherical tank.
4. To determine the force exerted by fluid jet on vanes, efficiency and performance of turbines and centrifugal pumps.

Course Outcomes: At the end of the course, the students can able to

1. Compute roughness coefficient in uniform flows and Froude number, energy losses in non-uniform flows.
2. Determine the coefficient of discharge of a venturi flume in open channels.
3. Compute super elevation in curved channel and coefficient of discharge in a hemi spherical tank.
4. Determine work done by fluid jet on vane, compute work done and draw performance characteristic curves for turbines and centrifugal pumps.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	1	-	-	-	1	2	1
CO2	3	1	-	-	-	-	-	-	1	-	-	-	1	2	1
CO3	3	1	1	-	-	-	-	-	1	-	-	-	1	2	1
CO4	3	1	-	-	-	-	-	-	1	-	-	-	1	2	1
CO5	3	1	1	-	-	-	-	-	1	-	-	-	1	2	1

List of experiments

1. Uniform flow in channels - Determination of Manning's Rugosity coefficient, Chezy's constant.
2. Curved Channel flow - Determination of super elevation
3. Hydraulic Jump - Determination of Froude number, loss of energy, type of jump.
4. Venturi flume - determine coefficient of discharge in open channel.
5. Impact of Jets - Determination of force on flat vane and curved vane.
6. Unsteady flow in a hemi -spherical tank.
7. Pelton Wheel turbine-Determine the efficiency and construct performance characteristics of Pelton wheel turbine.
8. Francis Turbine- Determine the efficiency and construct performance characteristics of Francis turbine.
9. Kaplan Turbine- Determine the efficiency and construct performance characteristics of Kaplan turbine.
10. Centrifugal Pump- Determine the efficiency and construct operating characteristics curves for constant speed pump.

Text Books:

1. M.N. Shesha Prakash, "Experiments in Hydraulics and Hydraulic Machines – Theory and Procedures", PHI Learning Private Limited, 2011.
2. R.V.Raikar, "Laboratory Manual Hydraulics and Hydraulic Machines-PHI Learning Private Limited,2012

22CE C15

SURVEYING AND GEOMATICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: To enable the students

1. To know the use of simple survey instruments in the field.
2. To develop topo maps from the field data.
3. To get exposure to modern surveying instruments for solving the problems
4. To understand the concepts of automation in surveying.
5. To be in a position to set the curves by using various methods and identifying the data required to be computed for the same.

Course Outcomes: At the end of the course the student should have learnt

1. To use simple as well as modern surveying instruments.
2. To develop L.S and C.S for road works, Canal works, using Auto levels and to develop contour map of the given area.
3. To use Total Station for locating ground details and plotting.
4. To set simple curves using Total Station.
5. To locate ground features using GPS.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	1	-	-	-	-	-	-
CO2	2	1	2	-	-	-	-	-	1	-	-	1	-	-	-
CO3	2	1	2	-	-	-	-	-	1	-	-	-	-	-	-
CO4	2	1	1	1	-	-	-	-	1	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	1	-	-	-	-	-	-

LIST OF EXPERIMENTS:

1. Ranging, running perpendicular lines and types of offsets by using chain, tape, cross staff.
2. Use of prismatic compass for measuring the area of a given land by using compass traverse.
3. Introduction to plane table work. - Radiation and intersection methods.
4. Introduction to levelling - Fly levelling using Auto level.
5. Development of L.S. and C.S after obtaining levels by using Auto levels.
6. Developing contour maps.
7. Measurement of horizontal angles using theodolite.
8. Study of Total station operations.
9. Traversing by Total station.
10. Setting of simple curve with the help of Total Station.
11. Study of GPS operations.
12. Establishing control points using GPS.
13. Demonstration of Remote Sensing Data processing software

Suggested Reading:

1. B. C. Punmia and A. K. Jain," *Surveying and Levelling", Vol. I and II*, Laxmi Publications, 2016.
2. Subramanian, *"Surveying and Levelling*", Oxford Higher Education, 2012.

22CE C16

SOLID MECHANICS LAB

Instruction	3P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: To know and understand the mechanical characteristics of various engineering materials by conducting different tests.

1. Mechanical properties of engineering materials under different structural actions like direct tension, compression, flexure and torsion.
2. Measurement of deflections and hence there by finding elastic properties.
3. To assess the behavior of steel rods under impact loads and shear.
4. To conduct torsion test and to conduct deflection test on helical spring and
5. To conduct compressive strength on brick and concrete cube

Course Outcomes: At the end of the course, the students will be able

1. To understand the stress strain behavior of mild steel bar under direct tension.
2. To compute the modulus of elasticity of given materials by conducting deflection tests on different types of beams.
3. To determine the impact/ shear strength of steel specimen.
4. To determine the rigidity modulus of a given material by conducting torsion test and deflection test on helical spring.
5. To determine the compressive strength of brick and concrete cube.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO2	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO3	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO4	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
CO5	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1

List of Experiments:

1. Direct tension test on mild steel bar.
2. Deflection test on Simply Supported beam.
3. Deflection test on Cantilever beam.
4. Deflection test on Propped cantilever beam.
5. Deflection test on Continuous beam.
6. Impact test.
7. Shear strength of a steel bar.
8. Torsion test.
9. Deflection test on helical spring.
10. Compression test on brick and concrete cube.

Suggested Reading:

1. William Kendrick Ha, "*Laboratory Manual of Testing Materials*", Bibliolife, 2009.

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

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

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	-
Credits	No Credits

Prerequisite: Knowledge of social studies.

Course Objectives: The course will introduce the students to:

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

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

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

CO-PO Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	-	-	1	-	-	1	1	1	1	-	-	-	-	-	1
CO2	-	-	2	-	-	3	2	2	1	-	-	-	-	-	2
CO3	-	-	1	-	-	1	1	-	-	-	-	-	-	-	1
CO4	-	-	1	-	-	1	1	-	-	-	-	-	-	-	1
CO5	-	-	2	-	-	3	2	1	1	-	-	-	-	-	2

Unit-I

Constitutional History and Framing of Indian Constitution

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

Unit-II

Fundamental Rights, Duties and Directive Principles of State Policy

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

Unit-III

Union Government and its Administration

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

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

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

Text Books
1. **Indian Government & Politics**, Ed Prof V Ravindra Sastry, Telugu Akademy, 2nd edition, 2018.
2. **Indian Constitution at Work,** NCERT, First edition 2006, Reprinted in 2022.

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

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

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2024-25

BE (Civil Engineering)

SEMESTER – V:

Sl No	Course code	Title of the Course	Scheme of instruction			Scheme of examination			Credits
			Hour per week						
			L	T	P	Duration of SEE in hours	Max Marks		
							CIE	SEE	
1	22CE C17	Transportation Engineering	3	-	-	3	40	60	3
2	22CE C18	Hydrology and Water Resource Engineering	3	-	-	3	40	60	3
3	22CE C19	Structural Analysis - II	3	-	-	3	40	60	3
4	22CE C20	Design of Steel Structures - I	3	-	-	3	40	60	3
.5	-	PE-2	3	-	-	3	40	60	3
6	-	OE-1	3	-	-	3	40	60	3
7	22CE C21	Transportation Engineering Lab	-	-	2	3	50	50	1
8	22CE C22	Engineering Geology Lab	-	-	2	3	50	50	1
9	22CE M01	Environmental Science (MC)	2	-	-	2	-	50	Non-Credit
10	22EG C03	Employability Skills	-	-	2	3	50	50	1
11	22CE I02	Industrial / Rural Internship	3-4 weeks/ 90 hours				50	-	2
Total			**20**	**-**	**6**	**-**	**440**	**560**	**23**
Clock Hours per week: 26									

L: Lecture **T: Tutorial** **P:Practical / Drawing / Seminar /**

Project CIE: **Continuous Internal Evaluation** **SEE: Semester End**

Examination Professional Elective-2 (PE-2)

Subject code	Subject Name
22CE E05	Applications of Artificial Intelligence in Civil Engineering
22CE E06	Pre-Stressed Concrete
22CE E07	Hazards and Management
22CE E08	Masonry Structures

Open Electives - 1 (OE-1)

22EE O01	Energy Management System
22ME O02	3D Printing
22EC O04	Basics of Digital Signal Processing

22CE C17

TRANSPORTATION ENGINEERING

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: To enable the students to

1. To understand the design concepts of the highways, the quality of the materials required for the construction of highways and different techniques used in construction of flexible and rigid pavements.
2. To know how to collect the field data for the evaluation of traffic patterns.
3. To get an idea about the concepts of designing flexible and rigid pavements.
4. To know the construction techniques of pavements.
5. To Know about pavement failures and maintenance of pavements.

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

1. Outline the components of highway alignment.
2. Design various geometric components of highway as per design standards.
3. Illustrate critical aspects of traffic engineering for efficient road traffic operations.
4. Design flexible pavements as per IRC standards.
5. Design rigid pavements as per IRC standards.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	2	3	-	-	-	-	2	-	-	-	1	2	-	3
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	-	3
CO4	2	2	3	-	3	-	-	2	-	-	-	1	2	-	3
CO5	2	2	3	-	-	-	-	2	-	-	-	1	2	-	3

UNIT- I:

Highway Alignment: Objectives and phases of highway engineering, history of highway engineering, factors to be considered for highway alignment, engineering surveys, concepts of master plan, road patterns, highway project preparation, and classification as per IRC.

UNIT- II:

Geometric Design: Highway standards (IRC) - carriageway, shoulders, medians, camber, right of way, footpaths, cycle tracks, service roads, frontage roads, sight distance - stopping sight distance, overtaking sight distance, horizontal curves, super-elevation, transition curve, extra widening, gradient, and grade compensation.

UNIT- III:

Traffic Engineering: Objectives of traffic studies, traffic characteristics, volume, speed, density, headways and relationship among them. Traffic volume studies, speed and delay studies, origin and destination studies, intersection delay studies, parking and accident studies, highway capacity and level of service concept as per HCM 2010, intersection improvement studies at grade, and types of grade separated intersections, channelization, rotary planning and design, concept of signal design – Webster's method.

UNIT- IV:

Design of Flexible Pavement: Variables considered in pavement design; classification of axle types, standard

and legal axle loads, tyre pressure, contact pressure, ESWL, concepts; traffic analysis: ADT, AADT, truck factor, growth factor, lane distribution factor, directional distribution factor, and vehicle damage factor; IRC method of flexible pavement design.

UNIT- V:

Design of Rigid Pavement: Types of Rigid Pavements; Layers in rigid pavement; Stresses in rigid pavement; Factors governing design - Axle load characteristics; wheel base characteristics; Traffic considerations; Design lane; Critical stresses conditions; IRC method of design for plain jointed cement concrete pavement.

Text books:

1. S. K. Khanna, C. E. G. Justo, and A. Veeraraghavan, "*Highway Engineering*", revised 10th Edition, Nem Chand & Bros., 2017.
2. S.K. Sharma, "Principles, Practice and Design of Highway Engineering", S. Chand Publishers, 2015.

Suggested Reading:

1. R. Srinivas Kumar," *Pavement Evaluation, Maintenance and Management systems*", Universities Press, 2014.
2. L. A. Garber and N. J. Hoel, K. RamachandraRao, "*Traffic and Highway Engineering*, 5th Edition, 2017. Cengage learning India Pvt. Ltd., New Delhi
3. Dr. L.R. Kadiyali and Dr. N.B. Lal, "Principles and Practices of Highway Engineering", Khanna Publishers, 2018.
4. IRC 37:2018, "Flexible pavement design".
5. IRC 58:2015, "Rigid pavement design".

E-Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105107/

22CE C18

HYDROLOGY AND WATER RESOURCES ENGINEERING

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: To enable the students to

1. Rainfall and measurement of rainfall, surface hydrology.
2. Runoff process and its quantification, reservoir capacity and its life.
3. Groundwater concepts and its flow process, irrigation practices.
4. Canal system, design theories, and canal outlets.
5. Design of Gravity dams, earth dams and seepage control, spillway types.

Course Outcomes: On completion of the course students will be able to

1. Understand the interaction among various processes in the hydrologic cycle and Rain Gauge networks.
2. Analyze hydrograph and estimate yield and life of a reservoir.
3. Estimate different aquifer parameters, yield of an open well. Estimate water requirement for irrigation and understand different irrigation efficiencies.
4. Design lined and unlined canals using Kennedy's and Lacey's theory.
5. Design gravity dams, earth dams and understand the functioning of spillways.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	1	-	1
CO3	3	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	-	1
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	-	1

UNIT- I:

Introduction: Hydrologic cycle, water budgeting, scenario of water resources in India, hydrology applications in engineering.

Precipitation: forms, characteristics and measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area-duration relationships, depth-duration-frequency relationship, Probable Maximum Precipitation.

Infiltration, infiltration capacity, infiltration indices, factors affecting infiltration, evaporation, and evapotranspiration

UNIT- II:

Runoff: runoff, factors affecting runoff, estimating runoff, flow-duration curve, flow-mass curve, hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph, S- hydrograph and its uses.

Reservoirs: Types, selection of suitable site, capacity of reservoirs, yield of reservoir, flood estimation, flood routing through reservoirs, sedimentation, and life of reservoir.

UNIT- III:

Ground water: Occurrence of groundwater, groundwater basin, vertical distribution of ground water, types of aquifers, aquifer parameters, specific yield, safe yield, steady radial flow into a confined and unconfined aquifer, Darcy's law, three-dimensional groundwater flow equation.

Irrigation: Duty, delta and base period of crops, crop water requirements, methods of applying water to the fields, micro irrigation, Lift irrigation, irrigation efficiencies, soil-water relationship, depth of irrigation, frequency of irrigation, wilting point, Conjunctive use.

UNIT- IV:
Distribution systems –Types of canals, alignment, balancing depth, design of canals, Kennedy's and Lacey's theory, canal losses, lining of canals.

Introduction to canal regulation works, cross drainage works.

Canal outlets: non-modular, semi-modular and modular outlets. Introduction to diversion head works and its components.
UNIT- V:
Gravity dams: Types of dams, forces on gravity dams, causes of failure, stress analysis and design, practical profile and economical height of dam.
Earth dams: Classification, failures of earth dam, design considerations, seepage control and slope protection.
Spillways: Introduction, types spillways, spillway gates.
Text Books:

1. P. N. Modi, "*Irrigation Water Resources & Water Power Engineering*", Standard Publishers, 2014
2. S. K. Garg, "*Irrigation Engineering and Hydraulic Structures: Water Resources Engineering - Vol*.II", Khanna Publishers, Delhi, 2017.

Suggested Reading:

1. Ch. S. N. Murthy, "*Water Resources Engineering: Principles and Practice*", New Age International Publishers, Delhi, 2002.
2. G. L. Asawa, "*Irrigation and water Resources engineering",* New Age International Publishers, Delhi, 2005.
3. VenTe Chow, "*Hand book of Applied Hydrology",* McGraw-Hill Book Company, New York, 1964

E-Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105110/.
2. https://archive.nptel.ac.in/courses/105/103/105103213/

22CE C19

STRUCTURAL ANALYSIS – II

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 Objective: To enable the students to

1. To impart the principles of influence lines for analyzing the effect of moving loads on deck slab.
2. To impart the knowledge of analyzing the truss bridge for moving loads.
3. To impart knowledge about various methods (slope-deflection and moment distribution methods) involved in the analysis of indeterminate structures.
4. To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
5. To make the student familiar with matrix methods viz. Flexibility and stiffness methods.

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

1. Determine the maximum SF and BM for various positions of the moving point loads and uniformly distributed loads.
2. Evaluate the maximum forces for various positions of the moving point loads and uniformly distributed loads.
3. Apply slope deflection method for indeterminate beams subjected to various loads.
4. Evaluate indeterminate beams with moment distribution method.
5. Analyse continuous beams using matrix methods approach.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-	2

UNIT– I:

Moving loads: Influence line diagrams for support reactions, shear force and bending moment for a simply supported beam/girder traversed by (i) single point load, (ii) two point loads (iii) uniformly distributed load longer than the span, (iv) uniformly distributed load shorter than the span and (v) several point loads. Determination of maximum values of support reactions, shear force and bending moment at any section for various moving load systems on simply supported beam/ girder.

UNIT– II:

Moving loads on truss girders: Influence lines for forces in the members of statically determinate trusses like Warren truss, Pratt truss, and Curved flange trusses. Determination of maximum forces in truss members due to moving point loads and uniformly distributed loads. Counter bracing.

UNIT– III:

Slope-deflection method: Analysis of Indeterminate beams with and without sinking of supports and Analysis of rigid jointed plane frames with and without lateral sway. Shear force and bending moment

UNIT- IV:

Moment distribution method: Analysis of Indeterminate beams with and without sinking of supports and Analysis of rigid jointed plane frames with and without lateral sway. Shear force and bending moment diagrams.

UNIT- V:

Matrix methods of structural analysis: Introduction, Static and Kinematic Indeterminacy, Compatibility and Equilibrium equations.

Flexibility method of Analysis: Introduction, Analysis of continuous beams with static indeterminacy not exceeding three.

Stiffness method of Analysis: Introduction, Analysis of continuous beams with kinematic indeterminacy not exceeding three.

Text Books:

1. B.C Punmia, and A. K. Jain, "SMTS - II Theory of Structures", Laxmi Publications, New Delhi, 2017.
2. S. Ramamrutham, "Theory of Structures", Khanna Publishers, New Delhi, 2018.

Suggested Reading:

1. H. J. Shah, S. B. Junnarkar, "Mechanics of Structures Vol. II [Theory and analysis of structures]", 24th Edition, Charotar Publishing House Pvt. Ltd., 2015.
2. T. S. Thandava Moorthy, "Structural Analysis", 2nd edition, Oxford University Press, 2012.
3. C. S. Reddy, "Basic Structural Analysis", 3rd Ed., Tata McGraw Hill, New Delhi, 2017.

E Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105109/
2. https://archive.nptel.ac.in/courses/105/101/105101086/

22CE C20

DESIGN OF STEEL STRUCTURES - I

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

Codes required: IS 800 – 2007, IS 875 Part II & Part III and Steel Tables. Course

Course Objectives: To enable the students to

1. Learn and apply the design philosophies for various steel structural components and their connections, as per the relevant standards.
2. To understand the behaviour of compression members.
3. To understand the modes of failure of tension members.
4. To understand the behaviour of flexural members in the industry.
5. Learn the behaviour of trusses and design of purlins.

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

1. Illustrate the material properties, design philosophies and design connections.
2. Design simple, built-up compression members and column bases.
3. Design tension members using limit state method.
4. Design simple flexural members including secondary considerations.
5. Analyze and design roof trusses.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO2	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO3	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO4	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO5	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-

UNIT – I:

Materials and Specifications: Chemical composition of steel, types of Structural Steel, classification of Rolled Steel Sections.

Design Philosophies: Working Stress Method, Limit State Method, Loads and Load Combinations, Partialsafety factors for materials and loads.

Bolted Connections (Limit State Method):

Bolted Joints -Modes of failure - Design of Bolted joints using ordinary Black Bolts - Lap & Butt joints – Concentric Connections and Eccentric Connections.

Welded Connections (Limit State Method): Types of Welds, Lap and Butt Joints- strength of welded joints -design of welded joints - Concentric Connections and Eccentric Connections.

UNIT – II

Design of Compression Members (Limit State Method): Introduction, yielding & Buckling phenomena, Sections used for compression Members. Effective Length of Compression Members, Design of Compression Members with single section and Built-up Sections, Lacing and Battening, Column Splices.

Design of Column Bases: Design of Slab Base.

UNIT – III

Design of tension members (Limit State Method): Introduction to tension members - Applications of tension members, Modes of Failure, Design of Tension Members –Staggered bolting, Design of Lug Angles.

Working Stress Method as per IS 800-2007: Permissible Stresses, Slenderness Ratio, Design of tension members, Design of Simple Compression Members.

UNIT – IV

Design of Beams (Limit State Method) : Introduction to Plastic Analysis –Plastic Hinge, Plastic moment, Shapefactor; Classification of Cross Sections, Phenomenon of Lateral Torsional Buckling; Design of Laterally Supported beams and laterally Unsupported Beams, Secondary considerations - Check for Web crippling, web buckling & deflection.

UNIT – V

Design of Roof trusses (Limit State Method): Types of trusses, Estimation of loads- dead load, live load and wind load, Design of purlins, Analysis of roof trusses and design of its members with angle sections.

Text Books:

1. S. K. Duggal, "Limit State Design of Steel Structures", 3rd Edition, McGraw Hill HED, 2019.
2. N. Subramanian, "Design of Steel Structures, Limit States Method", 2nd Edition, Oxford University Press,2016

Suggested Reading:

1. M.R. Shiyekar, "Design of Steel Structures, (Limit State Method", Second Edition, PHI Learning Pvt Ltd.2013.
2. S. S. Bhavikatti, "Design of steel Structures", 3rd Edition, I.K. International Publishing House Pvt. Ltd. 2012

E Resources:

1. https://nptel.ac.in/courses/105105162
2. https://archive.nptel.ac.in/courses/105/106/105106112/

22CE C21

TRANSPORTATION ENGINEERING LAB

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

Course Objectives: To enable the students to

1. Assess the quality of the materials used in pavement construction.
2. Compare the characteristics of pavement materials as per IRC design standards.
3. Identify and collect the field data required for the traffic parameters.

Course Outcomes: The student will be able to

1) Evaluate the properties of bitumen for its suitability in pavement construction.
2) Determine the mechanical properties of aggregates for its use in road construction.
3) Analyze the traffic data obtained from various traffic studies.
4) Prepare technical report based on laboratory and field studies.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	3	-	-	-	-	2	-	-	-	2	1	3
CO2	2	1	3	3	-	-	-	-	2	-	-	-	2	1	3
CO3	2	1	3	3	3	-	-	-	2	-	-	-	2	3	3
CO4	2	1	1	3	-	-	-	-	-	-	-	-	2	1	3

A) Tests on bitumen

1. Penetration test
2. Ductility test
3. Softening point test
4. Specific gravity test
5. Viscosity test

B) Tests on road aggregates

1. Aggregate crushing value test
2. Los Angeles abrasion test
3. Aggregate impact value test
4. Aggregate shape test (flakiness & elongation)
5. Water Absorption test

C) Traffic Studies

1. Traffic volume study
2. Spot Speed study

D) Miscellaneous Tests (demonstration only)

1. Determination of CBR.
2. Preparation of representative sample by coning and quartering.
3. Bitumen extraction test
4. Marshall Stability concepts and tests.

Suggested Reading:

1) Khanna and Justo, "*Highway materials and Pavement Testing*", Nem Chand & Bros. 2013.
2) R. Srinivasa Kumar, "*Highway Engineering*", Universities Press, 2011.
3) IRC codes and specifications.

E Resources:

1. https://nptel.ac.in/courses/105105107
2. https://www.vlab.co.in/ba-nptel-labs-civil-engineering.

22CE C22

ENGINEERING GEOLOGY LAB

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

Course objectives: To enable the students to

1. To equip students with the fundamental knowledge and skills necessary to accurately identify and classify various minerals and rocks based on their physical characteristics
2. To provide students with the theoretical knowledge and practical skills needed to accurately understand structural features such as folds, faults, and unconformities
3. Enabling students with the knowledge necessary to evaluate the electrical resistivity of different geomaterials which is useful for engineering and environmental investigations
4. To develop students; ability to effectively interpret topographic maps, enabling them to apply this knowledge in engineering planning and design, for a variety of projects
5. To equip students with the skills necessary to examine and assess the geological and geotechnical features of various locations for site evaluation, risk assessment, and engineering project planning.

Course Outcomes: Upon the Completion of this course students will be able to

1. Identify various minerals and rocks based on their physical characteristics
2. Classify structural features like folds, faults and unconformities.
3. Evaluate the electrical resistivity of rocks, soil etc.
4. Interpret topographic maps for engineering purposes
5. Examine the geological and geotechnical features of given places

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	3	-	-	-	-	2	2	-	1	-	2	2
CO2	2	-	-	3	-	-	-	-	2	2	-	1	-	2	2
CO3	2	-	-	3	3	-	-	-	2	2	-	2	-	2	2
CO4	2	-	-	3	-	-	-	-	2	2	-	1	-	2	2
CO5	2	-	-	3	-	-	-	-	2	2	-	1	-	2	2

List of Experiments:

1. Identification and description of physical properties of minerals.
2. Identification and description of Geotechnical characteristics of Rocks
   i) Igneous rocks
   ii) Sedimentary rocks
   iii) Metamorphic rocks
3. Study of structural models, folds, faults, unconformities, sills, and dikes.
4. Measurement of strike and dip of joints in granites using clinometers compass.
5. Measurement of electrical resistivity of rocks, soils and water using Wenner array method.
6. Study of geological and Geotechnical map of Telangana, Andhra Pradesh and India.
7. Study of maps and sections pertaining to the study of folds, faults and unconformities.

Suggested Reading:

1. Suggested Reading: 1. IS 113-1975, “Method of Identification of natural Building stones”, Bureau of Indian Standards.
2. Principles of Engineering Geology, K.M. Bangar, Standard publishers’ distributors, 2020

3. Introduction to Mineralogy, William D. Nesse, Oxford University Press, Third Edition (2016)
4. “Textbook of Engineering Geology”, N Chenna Kesavulu, Macmillan India Limited,2018

E Resources:

1. https://nptel.ac.in/courses/105105106
2. https://www.vlab.co.in/ba-nptel-labs-civil-engineering

22CE M01

ENVIRONMENTAL SCIENCE

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

Course Objectives: To enable the students to

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. To identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, student is able to

1. Identify various natural resources and effects of their over utilization.
2. Outline the working mechanism of ecosystem.
3. Illustrate the importance of bio-diversity conservation.
4. Identify remediation measures for environmental pollution through legislations.
5. Explain environmental issues and possible sustainable solutions.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	2	2	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	1	1	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	2	2	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	2	2	2	-	-	-	2	-	-	-
CO5	3	1	-	-	-	2	3	-	-	-	-	-	-	-	-

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

E Resources:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://archive.nptel.ac.in/courses/120/108/120108004/

22EG CO3

EMPLOYABILITY SKILLS

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: To enable the students to

1. To develop analytical abilities
2. To develop communication skills
3. To introduce the students to skills necessary for getting, keeping and
4. being successful in a profession.
5. To expose the students to leadership and team-building skills.

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

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

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	2	2		-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-		-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-		-	-	-
CO4	-	2	-	-	-	-	-	2	-	-	2		-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-		-	-	-

UNIT 1

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

UNIT 2

Group Discussion & Presentation Skills: Dynamics of Group Discussion-Case Studies- Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence.Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language - Preparing an Effective PPT

UNIT 3

Behavioural Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management-
Corporate Culture – Grooming and etiquette-Statement of Purpose (SOP).

UNIT 4

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

UNIT 5

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

Suggested Reading:

1. Edgar Thorpe and ShowickThorpe, "Objective English", 2nd edition, Pearson Education, 2007.
2. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.
3. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Aggarwal, 2018.

E Resources:

1. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
2. https://onlinecourses.nptel.ac.in/noc21_hs06/preview

22CE E05

APPLICATION OF ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING

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: To enable the students to

1. To identify the sources and characteristics of civil engineering data.
2. To find the hidden patterns within the data by processing the raw data.
3. To use the information obtained in order to make civil engineering project decisions.
4. Study the applications of data analytics in civil engineering.
5. To identify various open-source tools and resources related to data analytics.

Course Outcomes: On Successful completion of this course, student will be able to

1. Recall fundamental knowledge on artificial intelligence.
2. Outline neural networks and their types and apply neural networks in the domain of civil engineering.
3. Illustrate and apply fuzzy controllers to solve real-world civil engineering problems.
4. Explain basic concepts of support vector machines and choose appropriate techniques relevant to civil engineering.
5. Develop a regression model for civil engineering problems.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3	1	-	1	-	-	-	-	-	-	1	2	-	-
CO3	2	3	1	-	1	-	-	-	-	-	-	1	2	-	-
CO4	2	3	1	-	1	-	-	-	-	-	-	1	2	-	-
CO5	2	3	1	-	1	-	-	-	-	-	-	1	2	-	-

UNIT I:

Introduction: Introduction and Brief history of intelligent systems: ELIZA, categorization of intelligent systems, components of AI program. Foundations of AI, sub areas of AI, applications, current trends in AI.

UNIT II:

Artificial Neural Networks: introduction, artificial neural networks: neuron model, activation functions, neural network architecture. Single layer feed forward networks, multi-layer feed forward networks, radial basis function networks, design issues of artificial neural networks, recurrent networks. Applications of ANN in civil engineering.

UNIT III:

Fuzzy sets and fuzzy logic: introduction, fuzzy sets, fuzzy set operations, types of membership functions, multivalued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules, fuzzy systems. Applications of fuzzy set and fuzzy logic in civil engineering.

UNIT IV:

Machine learning: introduction, machine learning systems, supervise and unsupervised learning, inductive and deductive learning, clustering, support vector machines. Applications of Machine learning in civil engineering

UNIT V:

Regression Analysis: Relationship between attributes using Covariance and Correlation, Relationship between multiple variables: Regression (Linear, Multivariate) in prediction. Residual Analysis, Hypothesis testing of Regression Model, R-square and goodness of fit, Multiple Linear Regression, Non-Linear Regression, logistic regression. Applications of Regression analysis in civil engineering.

Text Books:

1. Pijush Samui, Dwarkadas Pralhaddas Kothari, Artificial intelligence in Civil Engineering: AI in CivilEngineering, 2012.
2. Ian Flood, Nabil Kartam, and Artificial Neural Networks for Civil Engineers: advanced features andapplications, 1998.

Suggested Reading:

1. S.M Yadav, Application of soft computing techniques in civil engineering, 2018.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
3. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

E Resources:

1. https://engg.dypvp.edu.in/blogs/artificial-intelligence-in-civil-engineering
2. https://nptel.ac.in/courses/106102220

22CE E06

PRESTRESSED CONCRETE

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: To enable the students to

1. Understand the basic principles and structural behaviour of pre stressed concrete with reference to IS 1343 code.
2. Equip the students with a thorough understanding of the behaviour and analysis of PSC beams.
3. Understand and apply the design principles of PSC beams in flexure and shear.
4. Understand the concepts of various stresses in anchorage zone.
5. Identify the advantages of continuous beams and can analyze for primary and secondary moments.

Course outcomes: At the end of the course, Students will be able to

1. Explain the general mechanism of prestressed concrete members.
2. Analyze the behaviour of prestressed concrete beams.
3. Design prestressed concrete beams under flexure and shear.
4. Analyze and design anchorage zones in prestressed beams.
5. Analyze prestressed continuous beams.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	-	-	-	-	-	1	2	-	2
CO2	2	2	3	-	-	-		1	-	-	-	2	2	-	3
CO3	2	2	3	-	-	-	-	1	-	-	-	2	2	-	3
CO4	2	2	3	-	-	-	-	1	-	-	-	2	2	-	3
CO5	2	3	-	-	-	-	-	-	-	-	-	1	2	-	2

UNIT- I:

General Principles of Pre Stressed Concrete:

Introduction: Basic concepts Materials –Need for High strength materials. Advantages and Applications of prestressed concrete. Different methods of Pre stressing. Pre-tensioning and post-tensioning. Hoyer System, Freyssinet system, Magnel-Blaton system, Lee Mecal system. Use of IS 1343 code, concepts of pre tensioned and post tensioned elements.

UNIT II:

Analysis, Losses and Deflection of PSC beams: Analysis of sections for pre stress and flexure for Straight Concentric, Eccentric, Bent and Parabolic Tendons. Pressure Line Cable, concept of cracking moment of resistance. Load balancing concept.

Losses of Pre stress: Losses in P.S.C. members due to elastic shortening Shrinkage Creep in Concrete Relaxation of Steel Slip in anchorage Frictional Loss

Deflections of P.S.C members: Importance of deflections - factors influencing deflections, short term and long-term deflections IS code requirements for Maximum deflections Computation of short-term deflections due to prestressing force Dead and Live loads.

UNIT-III:

Design of Section for Flexure and Shear

Allowable Stresses: Elastic Design and Limit state method of Design of Rectangular and I Section beams for

Flexure. Check for ultimate flexural strength as per I S 1343 Codal Provisions. Check for deflections. Design of Section for Shear: Shear and principal stresses. Factors affecting shear resistance, Cracked and uncracked sections Codal provisions - ultimate shear resistance. Design of shear reinforcement in beams.

UNIT IV:
Anchorage Zone stress in Post tensioned members:
Stress distribution in End Block: Analysis by Magnel and Guyon's methods – IS 1343 Code Provisions – Bursting Tensile Force Design of anchorage zone reinforcement.

UNIT-V:
Continuous beams:
Advantage and Disadvantages – Primary and Secondary moment P and C –lines linear transformation, Concordant and Non-concordant cable profile – Analysis of Continuous beams

Text Books:

1. N. Krishna Raju, "Prestressed Concrete", Tata Mc Graw Hill, 6th edition 2018
2. G.S. Pandit and S.P. Gupta, "Prestressed Concrete", CBS Pub., 2019

Reference Books:

1. Arthur H. Nilson by "Design of Prestressed Concrete", John Wiley, 2nd edition, 1987
2. T.Y. Lin and Burn, "Design of Prestressed Concrete", Wiley India Private Limited, 3rd edition, 2010

E Resources:

1. https://archive.nptel.ac.in/courses/105/106/105106118/
2. https://nptel.ac.in/courses/105106117

22CE E07

HAZARDS AND MANAGEMENT

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: To enable the students to

1. To learn about fundamental disaster management (DM) concepts, DM cycle and the genesis of NDMA in India.
2. To make the students become aware of causes, impacts, early warning systems, structural and nonstructural measures of hydro-meteorological disasters through case-study approach.
3. To make the students become aware of causes, impacts, early warning systems, structural and nonstructural measures of geographical based disasters through case-study approach.
4. To identify the causes , impacts and mitigation measures of human induced disasters through case-study approach
5. To become aware of the post disaster environmental response and the institutions behind disaster management.

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

1. Outline the fundamental aspects of disaster management.
2. Identify the Hydro-meteorological disasters and corresponding mitigation measures.
3. Explain different geographical disasters and corresponding mitigation measures.
4. Compile causes, impacts and mitigation measures of various human induced disasters.
5. Analyze the plausible impacts of a disaster and the institutional framework of disaster management.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	-	-	-	-	-	-	1	1	1	1
CO2	1	2	3	-	2	-	-	2	-	-	-	1	1	1	-
CO3	2	2	3	-	2	-	-	2	-	-	-	1	1	-	-
CO4	2	2	3	-	3	-	-	2	-	-	-	1	-	-	-
CO5	2	2	3	-	2	-	-	-	-	-	-	1	1	1	1

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and manmade; Introduction to Disaster management cycle; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA) Objectives.

UNIT- II:

Natural Disasters: **Hydro meteorological disasters**: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Applications. Case studies related to various hydro-meteorological disasters.

UNIT- III:

Geographical based disasters: Causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various geographical based disasters.

UNIT- IV:

Human Induced Disasters: Chemical disaster- Causes, impacts and mitigation measures for chemical

accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas leakage; Management of chemical terrorism disasters and biological disasters; Case studies related to power break downs, fire accidents, traffic accidents, oil spills and stampedes, building failure disasters, Impact of COVID 19 at national and international level.

UNIT- V:

Concept of Disaster Impacts and Management: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects, gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

Disaster management cycle and its phases, risk analysis, vulnerability and capacity assessment; Post-disaster environmental response water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003
2. B.K. Singh, "Handbook of Disaster Management: Techniques & Guidelines", Rajat Publication, 2008

Suggested Reading:

1. K.K. Ghosh, "Disaster Management", APH Publishing Corporation, 2006
2. Disaster Medical Systems Guidelines, Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
3. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings, Geneva: IASC.

E Resources:

1. https://archive.nptel.ac.in/courses/105/104/105104183/
2. https://archive.nptel.ac.in/courses/110/105/110105160/

22CE E08

MASONRY STRUCTURES

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: To enable the students to

1. Masonry materials and its mechanical properties.
2. Analysis and the behaviour of structural masonry.
3. Shear and flexural behaviour of Reinforced and unreinforced masonry.
4. Summarize construction practices, seismic behaviour, specifications, for Design of masonry.
5. Seismic evaluation and Retrofit of Masonry.

COURSE OUTCOMES: At the end of the course, the students will be able to,

1. Explain engineering properties, uses of masonry units, defects, crack in masonry and its remedial measures.
2. Illustrate the different masonry elements, permissible stresses, design considerations and criteria as per IS:1905 and SP-20.
3. Design different types of masonry walls subjected to axial loads; UDL and concentrated axial loads.
4. Design different types of masonry walls subjected to eccentric loads, lateral loads and transverse loads
5. Design infill walls of frames and implement the design principles and detailing aspects to ensure seismicsafety of unreinforced and reinforced masonry walls.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-	3
CO3	2	2	3	-	-	-	-	2	-	-	-	1	2	-	3
CO4	2	2	3	-	-	-	-	2	-	-	-	1	2	-	3
CO5	2	2	3	-	-	-	-	2	-	-	-	1	2	-	3

UNIT I

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units-strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding and repairing cracks

Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

UNIT II

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

UNIT III

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of

walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

UNIT IV

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs.

UNIT V

In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

Seismic safety Considerations for Masonry walls: Design principles, detailing aspects and construction features for seismically safe masonry structures (both – unreinforced and reinforced)

Text Books:

1. Dayaratnam P, Brick and Reinforced Brick Structures, Scientific International Pvt. Ltd.
2. M. L. Gambhir, Building and Construction Materials, McGraw Hill education Pvt. Ltd.
3. Henry, A.W., " Structural Masonry" , Macmillan Education Ltd., 1990.

References:

1. IS 1905–1987 "Code of practice for structural use of un-reinforced masonry- (3rd revision) BIS, New Delhi.
2. SP 20 (S&T) – 1991, "Hand book on masonry design and construction (1 st revision) BIS, New Delhi.
3. Richard E. Klingner. Masonry Structural Design (The McGraw-Hill Companies, Inc, 2010).

E Resources:

1. https://archive.nptel.ac.in/courses/105/106/105106197/
2. https://onlinecourses.nptel.ac.in/noc19_ce21/preview

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2023-24

BE (Civil Engineering)

SEMESTER – VI

Sl. No.	Course Code	Title of the Course	Scheme of instruction			Scheme of examination			Credits
			Hours per week						
			L	T	P	Duration of SEE in hours	Max marks		
							CIE	SEE	
1	22CE C23	Environmental Engineering	3	-	-	3	40	60	3
2	22CE C24	Geotechnical Engineering	3	-	-	3	40	60	3
3	22CE C25	Reinforced Concrete Design - II	3	-	-	3	40	60	3
4	22CE C26	Estimation, Specification & Costing	3	-	-	3	40	60	3
5	--	PE- 3	3	-	-	3	40	60	3
6	--	OE - 2	3	-	-	3	40	60	3
7	22CE C27	Environmental Engineering Lab	-	-	3	3	50	50	1.5
8	22CE C28	Geotechnical Engineering Lab	-	-	3	3	50	50	1.5
9	22CE C29	Mini Project	-	-	4	-	50	--	2
10	22CE U02	Upskilling Certification Course-II	-	-	-	-	25	-	0.5
	Total		**18**	**-**	**10**	**-**	**415**	**460**	**23.5**
	Clock Hours per week: 28								

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

Professional Electives (PE-3)

Subject code	Subject Name
22CE E09	Solid and Hazardous Waste Management
22CE E10	River Engineering
22CE E11	Urban Transportation Planning
22CE E12	Basics of Earthquake Engineering

Open Electives – 2 (OE-2)

Subject code	Subject Name
22BT O02	Biomaterials for Engineers
22ME O06	Principles of Entrepreneurships and Startups
22IT O03	Introduction to Cloud Computing

22CE C23

ENVIRONMENTAL ENGINEERING

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: To enable the students to

1. Understand methods of population forecasting, estimate water quantity to be supplied in towns and design water distribution network.
2. Understand and design various units of a water treatment plant.
3. Calculate sewage produced in residential areas and design conveyance components.
4. Learn about design components of waste water treatment plants, low cost treatment techniques and sludge digestion systems.
5. Address issues of air pollution with the aid of appropriate control methods.

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

1. Estimate the quantity of water to be supplied for a futuristic population.
2. Design treatment unit operations and processes for domestic water.
3. Design a sewerage system and its sewer appurtenances.
4. Design components of wastewater treatment plant and sludge digestion systems.
5. Evaluate methods for control of particulate matter and gaseous pollutants in the atmosphere.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	1	3	-	-	-	-	-	2	-	3
CO2	2	2	3	-	-	1	3	-	-	-	-	-	2	-	3
CO3	2	2	3	-	-	-	3	-	-	-	-	1	2	-	3
CO4	2	2	3	-	-	-	3	-	-	-	-	1	2	-	3
CO5	2	-	2	-	-	-	3	-	-	-	-	-	2	-	3

UNIT – I:

Introduction: Protected water supply, population forecasting methods, design period, types of water demand, factors affecting, fluctuations, fire demand, drinking water standards; sources of water, water quality parameters; intakes; Design and analysis of water distribution systems, pipe appurtenances.

UNIT – II:

Water treatment: Sedimentation principles-design factors; coagulation, flocculation, clarifier, coagulants, feeding arrangements. Filtration theory, working of slow and rapid gravity filters, multimedia filters, design of filters, troubles in operation, comparison of filters, disinfection, theory of chlorination, chlorine demand, other disinfection practices.

UNIT – III:

Characteristics of sewage: Wastewater collection, estimation of waste water and storm water, decomposition of sewage, self-purification of rivers, examination of sewage, B.O.D. Equation, C.O.D. Design of sewers, sewer shapes and materials, sewer appurtenances, house drainage, plumbing requirements, sanitary fittings, traps, one pipe and two pipe systems of plumbing.

UNIT – IV:

Waste water treatment: Primary treatment: screens, grit chambers, skimming tanks, sedimentation tanks, principles of design, biological treatment: Design of trickling filters, Activated Sludge Treatment and oxidation ponds. Sludge digestion: factors affecting, design of digestion tank, septic tanks: working principles and design, soak pits, ultimate disposal of sewage.

UNIT – V:

Air pollution: Meteorological parameters affecting air pollution, atmospheric stability, plume behaviour, controlof particulates, gravity settlers, cyclone filters, Electrostatic precipitators; Control of gaseous pollutants.

Text Books:

1. Santosh Kumar Garg, "*Water Supply Engineering*", Khanna Publications, 2017.
2. Santosh Kumar Garg, "*Sewage Disposal and Air Pollution Engineering*", Khanna Publications, 2018

Suggested Reading:

1. H.S Peavy, D. R. Rowe," *Environmental Engineering*", McGraw Hill Education (India) Pvt. Ltd, 2017.
2. Metcalf and Eddy, "*Wastewater engineering*", McGraw Hill, 2015.
3. Mark J Hammar and Mark J. HammarJr," *Water and Waste Water Technology*". Wiley, 2007.

E Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ch45/preview
2. https://onlinecourses.nptel.ac.in/noc22_ce22/preview
3. https://onlinecourses.nptel.ac.in/noc19_ge22/preview

Self-Learning Exercises:

Coursera: https://www.coursera.org/

22CE C24

GEOTECHNICAL ENGINEERING

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: To enable the students to

1. Understand the basic principles of soil mechanics, properties of soils and knowledge of identifying soil.
2. Understand the flow through soils and their behavior and gain a practical outlook of utilizing soil as construction materials.
3. Understand highly compressible soil settlements and estimate the strength of soil for different loading conditions.
4. Identify shear strength parameters of soil using different laboratory tests.
5. Interpret the problem of earth pressures and slope stability under different field conditions.

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

1. Identify various types of soils and determine their properties.
2. Estimate coefficient of permeability and stresses in soils under various site conditions.
3. Apply the knowledge of compaction and consolidation settlement to enhance the soil properties at site.
4. Examine the shear strength of different soils under various loading conditions.
5. Evaluate earth pressures and slope stability under different field conditions.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	2	-	-	-	-	-	-	2	-	3
CO2	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3
CO3	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3
CO4	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3
CO5	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3

UNIT- I:

Physical and Index properties of soils: Introduction about origin and formation of soils, basic definitions from soil three phase diagram (weight ratios & volume ratio), Inter relationships of preliminary properties. Determination of laboratory tests for water content, field density, specific gravity by various methods, Index properties, sieve analysis, consistency limits, Indian soil classification IS-1498-1970.

UNIT- II:

Permeability of soils: Darcy's. law of seepage water through soils- Determination of co-efficient of permeability (constant head and variable head permeability tests) – Field tests (Pumping in and pumping out tests) –Equivalent permeability of stratified soils.

Stress in Soils: Total, effective and neutral stress for different soil conditions.

Seepage in Soil: Seepage flow, seepage pressure – Flow nets – Locating phreatic line in a homogeneous earthen dam using Kozeny's parabola – computation of seepage quantity.

Quick Sand Phenomena: Critical Hydraulic gradient.

UNIT- III:

Compaction: Compaction Mechanism, factors affecting compaction. Laboratory determination of compaction characteristics- standard and modified Proctor tests – IS Light and Heavy compaction tests; Field surface compaction: compaction equipment, procedure, quality control.

Consolidation: Spring Analogy, Laboratory consolidation test, calculation of void ratio, compression characters and settlement equation, differential equation for one dimensional consolidation, co-efficient of consolidation – square root & logarithm time fitting method.

UNIT- IV:

Shear strength: Significance of Shear strength of soils – Mohr-Coulomb equation – shear parameters – Laboratory tests for determination of shear strength – Direct shear test, Tri-axial compression tests. (UU, CU and CD), Un-confined compression test, Vane shear test. Factors affecting shear strength of cohesion less and cohesive soils.

UNIT- V:

Earth pressure: States of earth pressure – Active, Passive and at rest condition; Rankine's theory; computation of active and passive earth pressure in cohesion less (ø) & Cohesive (c) soils and c-ø soils; Coulomb's Wedge theory; Rebhann's graphical solution.

Slope stability: Definition and classification of slopes – types of slope failures- Factors of safety with respect to cohesion, angle of shearing resistance, Height – Analysis of stability of slope using Swedish slip circle method and Taylor's stability number.

Text Books:

1.K. R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist.; 7th Edition, 2008

2.Gopal Ranjan and A S R Rao "Basic and Applied Soil Mechanics", New Age International Pvt Ltd; Third Edition 2016.

Suggested Reading:

1. R. F. Scott, "Principles of Soil Mechanics", Wesley Educational Publishers Inc., 1st edition, 1963.
2. T. W. Lambe and R. V. Whitman, "Soil Mechanics", Wiley; 17 edition, 2012.
3. C.Venkatramaiah, "Geotechnical Engineering", New Age Publications, revised Fifth edition, 2017.

E Resources:

1. https://archive.nptel.ac.in/courses/105/101/105101201/
2. https://archive.nptel.ac.in/courses/105/105/105105168/

22CE C25

REINFORCED CONCRETE DESIGN-II

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: To enable the students

1. To apply the salient features of the Working stress method and limit state method for designing RC structures.
2. To identify and tell the various codal provisions for the design of combined footings, water tanks, retaining walls, and bridges.
3. To analyze the behaviour and design RC structures for flexure, shear, tension, and compression.
4. To design structures with enhanced performance under limit state of collapse and limit state of serviceability.

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

1. Develop the plan layout, design and detail rectangular & trapezoidal combined footings.
2. Analyze for stability, design, the various components and detail cantilever and counter fort type retaining walls.
3. Interpret the specifications from relevant codes, determine the design forces, design various components and detail rectangular and circular water tanks including Intze tanks.
4. Understand the clauses from relevant IRC codes, design and detail the various components of Solid slab bridge.
5. Analyze the slab panels using effective width method/ Pigeaud‟s curves, girders using Courbon's method and design & detail the various components of T-Beam bridges.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	1	-	-	2	1	3
CO2	2	2	3	-	-	-	-	-	-	1	-	-	2	1	3
CO3	2	2	3	-	-	-	-	-	-	1	-	-	2	1	3
CO4	2	2	3	-	-	-	-	-	-	1	-	-	2	1	3
CO5	2	2	3	-	-	-	-	-	-	1	-	-	2	1	3

UNIT – I:

Combined Footings: Limit state design & detailing of combined rectangular and trapezoidal footings

UNIT – II:

Retaining walls: Limit state design and detailing of cantilever and counterfort type of retaining walls under various conditions of backfill.

UNIT – III:

Water tanks: Elastic Design & Detailing of circular and rectangular ground level and over-head tanks, Design principles of Intze tank.

UNIT – IV:

Bridges: Basic components- Types of bridges -Loads on bridges- IRC standards; Elastic design and detailing of two lanes, simply supported RC Solid Slab Bridge including Kerb.

UNIT- V:

T-beam bridges: Components of a T-beam bridge- Elastic design and detailing of two lane, Simply Supported, Three girder T-beam bridge- Use of effective width method- Pigeaud‟s curves and Courbons method.

Text Books:

1) N. Krishna Raju, "Advanced Reinforced Concrete Design (IS: 456-2000) ", CBS Publications 3rd Edition,2020.
2) Vazirani and Ratwani," Design Of Concrete Bridges", Khanna Publishers, 2nd edition, 1998.

Suggested Reading:

1) D. S. Prakash Rao, "Design Principles and Detailing of Concrete Structures", Tata McGraw-Hill Publishing Co. Ltd., 1998.
2) D. Johnson Victor, "Essentials of Bridge Engineering", paperback, Oxford & IBH, Publishing Co., New Delhi, 6th Edition, 2019.
3) S. Ponnuswamy, "Bridge Engineering", Tata McGraw Hill, Third Edition, 2017.

E Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105105/
2. https://onlinecourses.nptel.ac.in/noc23_ce79/preview

22CE C26

ESTIMATION, SPECIFICATION & COSTING

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: To enable the students to

1. The working of detailed estimates for different structures.
2. The Estimation of steel quantities of R.C.C Framed works and preparation of BBS.
3. The rate Analysis for different items of works and to prepare an abstract estimate
4. The procedures and guidelines related to the TSDSS and departmental procedures.
5. About the specifications and standard procedures for construction works.

Course Outcomes: At the end of the course the students should be able to

1. Apply long wall - short wall method to load bearing and RCC framed building for detailed estimate.
2. Prepare detailed estimates for load bearing and RCC framed building using centre line method.
3. Estimate steel quantity and prepare bar bending schedule for RCC framed works.
4. Determine the earth work for road and Canal Constructions.
5. Evaluate the rates for different items of works of buildings.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	3	2	2	-	3
CO2	2	2	-	-	-	-	-	-	-	-	3	2	2	-	3
CO3	2	2	-	-	-	-	-	-	-	-	3	2	2	-	3
CO4	2	2	-	-	-	-	-	-	-	-	3	2	2	-	3
CO5	2	2	-	-	-	-	-	-	-	-	3	2	2	-	3

UNIT – I:
Introduction of estimation, object of estimation, types of estimates, detailed estimate for flat roof building (load bearing and RCC framed) using long and short wall method.

UNIT – II:
Detailed estimated for flat roof building (load bearing and RCC framed) using centre line method.

UNIT – III:
Estimation of steel quantities and preparation of bar bending schedule (BBS) for RCC slabs (one way and two way), beams, columns, footings, stair case and retaining wall.

UNIT – IV:
Estimation of earth work for – bituminous roads, WBM roads and CC roads. Detailed estimate of single cell rectangular box culvert, septic tank and earth work of irrigation canals.

UNIT – V:
Preparation of analysis of rates and theoretical requirements of materials and schedule of rates for major items of a building. General and detailed specifications of works. Measurement book and muster roll.

Text Books:

1. Estimating Costing Specification & Valuation in Civil Engineering, M Chakraborti, National Halftone Co. Calcutta, 2006.
2. Estimating and Costing in Civil Engineering, B. N. Dutta, CBS Publishers & Distributors Private Limited, 2020.

Suggested Reading:

1. Estimating and Costing for Civil Engineering, G.S. Birdie, Dhanpat Rai Publishing Company Private Limited, 2014. 2.
2. Estimating and Costing (Civil), D. D. Kohli, R. C. Kohli, S Chand Publishing, 2013.
3. Estimating costing specification and valuation: in civil engineering: principles and applications, Kolkata Manojit Chakraborti 23rd ed, 2010.

E Resources:

1. https://onlinecourses.swayam2.ac.in/nou20_cs11/preview
2. https://archive.nptel.ac.in/courses/106/105/106105218/

22CEC27

ENVIRONMENTAL ENGINEERING LAB

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: To enable the students to

1. Evaluate the domestic surface- and ground- water to test the feasibility of drinking.
2. Assessing the severity of wastewater through analyzing quality parameters.
3. Perform the outdoor and indoor air quality parameters to observe the household and ambient air quality, respectively.
4. Comprehend the biological parameter estimations.

Course Outcomes: After the completion of the course student should be able to

1) Demonstrate titration methods to implement basic water quality properties.
2) Analyze water quality parameters through digital equipments.
3) Evaluate characteristics of wastewater as per the standards.
4) Measure air quality through quantifying the pollution levels in ambient air.
5) Categorize bacterial colonies present in water and wastewater.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	3	-	-	-	-	3	2	-	-	2	2	3
CO2	2	-	-	3	-	-	-	-	2	2	-	-	2	2	3
CO3	2	-	-	3	3	-	-	-	2	2	-	-	2	2	3
CO4	2	-	-	3	2	-	-	-	2	2	-	-	2	2	-
CO5	2	-	-	3	-	-	-	-	-	2	-	-	2	2	-

Practical Work*: List of Experiments*

1. Determination of pH & Electrical Conductivity
2. Determination of Turbidity & Optimum coagulant dosage
3. Determination of Total Solids
4. Determination of Alkalinity
5. Determination of Hardness
6. Determination of Chlorides
7. Determination of Residual Chlorine
8. Determination of COD
9. Determination of Dissolved Oxygen and BOD
10. Determination of Flourides
11. Determination of Sulphates and Nitrates
12. Measurement of Ambient Air Quality

Demonstration*: List of Experiments*

a. Determination of Most Probable Number
b. Analysis of Heavy Metals

Suggested Reading:

1. Government of India & Government of The Netherlands –Hydrology Project TechnicalAssistance, “Standard analytical procedures for water analysis”, May 1999.
2. D. R. Khanna and R. Bhutiani, “Laboratory Manual of Water and Wastewater Analysis”, Daya Publishing House, 2008.
3. Central Pollution Control Board Annual Report of India, 2023.

E Resources:

1. https://ee1-nitk.vlabs.ac.in/
2. https://ee2-nitk.vlabs.ac.in/

22CE C28

GEOTECHNICAL ENGINEERING LAB

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: To enable the students to

1. Identify physical and mechanical properties of soil in the field and laboratory.
2. Develop an understanding the relationships between the physical characteristics and mechanical properties of soils;
3. Understand techniques used in soil mechanics for Darcy's Law
4. Understand Mohr-Coulomb theory for shear strength behavior of soils.
5. Choose different tests for soils according to IS standards.

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

1. Identify soils with reference to their index properties.
2. Classify soils according to IS classification.
3. Calculate coefficient of permeability for different soils.
4. Examine the shear strength of soils.
5. Conduct Laboratory and Field tests according to IS standards.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	3	-	-	-	-	2	2	-	-	2	2	3
CO2	2	2	-	3	-	-	-	-	2	2	-	-	2	2	3
CO3	2	2	-	3	-	-	-	-	2	2	-	-	2	2	3
CO4	2	2	-	3	3	-	-	-	2	2	-	-	2	2	3
CO5	2	2	-	3	-	-	-	-	2	2	-	3	2	2	3

List of Experiments:

1. Grain size distribution by Sieve Analysis.
2. Consistency limits - Liquid limit and Plastic limit using Casagrande's method.
3. Compaction test: Standard Proctor test.
4. Field Density using Sand Replacement method.
5. Field Density using Core Cutter method.
6. Specific gravity of soils.
7. Natural Moisture Content using Pycnometer method.
8. Direct Shear test.
9. Permeability test using Falling-head method.
10. Relative density

Demo Experiments:

1. Consolidation test
2. Triaxial test (UU)
3. Vane Shear test

Suggested Reading:

1. B. C. Punmia, "Soil Mechanics and Foundation Engg", (2005), 16th Edition Laxmi Publications Co., New Delhi.
2. IS: 2720(part-3 1964) for specific gravity, (IS : 2720 (Part 17), 1966) for Sieve analysis (IS : 2720 (Part- IV), 1965) for Grain size analysis, IS: 2720 (Part 1) - 1983 for shear strength tests and compaction.
3. T. W. Lambe," Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi, 1996.

E Resources:

1. https://nptel.ac.in/courses/105101160
2. https://archive.nptel.ac.in/courses/105/101/105101160/

22CE E09

SOLID AND HAZARDOUS WASTE MANAGEMENT

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

Course Objectives: To enable the students to

1. Understand legislations on management of solid waste management.
2. Gain insight into the transfer, transport and energy recovery from municipal solid waste.
3. Know the characteristics and handling of hazardous wastes.
4. Grasp the fundamentals of hazardous waste treatment techniques.
5. Know the regulations of site remediation and pollution prevention of hazardous wastes.

Course Outcomes: On completion of the course, students will be able to

1. Classify the solid wastes according to the standard guidelines.
2. Outline the solid waste management processes.
3. Assess the risks posed by hazardous wastes.
4. Select the site for disposal of hazardous waste and suggest remediation measures for waste mitigation.
5. Compare various legislations pertaining to solid- and hazardous-waste management

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	3	-	-	-	-	-	2	-	3
CO2	2	2	3	-	-	-	3	-	-	-	1	-	2	-	3
CO3	2	2	-	-	-	-	3	-	-	-	-	-	2	-	3
CO4	2	2	-	-	-	-	3	-	-	-	2	-	2	-	3
CO5	2	2	-	-	-	3	3	-	-	-	-	-	2	-	3

UNIT- I:

Solid wastes: Solid waste generation in a technological society - sources and types of solid waste –legislations on management and handling of municipal solid wastes, monitoring responsibilities; Collection of Solid Waste: type of waste collection systems, analysis of collection system - alternative techniques for collection system.

UNIT- II:

Management of Solid waste: Separation and Processing and Transformation of Solid Waste: unit operations used for separation and processing, Materials Recovery facilities, Waste transformation through combustion and anaerobic composting, anaerobic methods for materials recovery and treatment - Energy recovery - Incinerators. Transfer and Transport: need for transfer operation, transport means and methods. Disposal of Solid wastes, Bioremediation techniques.

Landfills: Site selection, drainage and leachate collection systems- requirements and technical solutions, integrated waste management facilities.

UNIT- III:

Hazardous waste: Definition and identification of hazardous wastes - sources and characteristics - hazardous wastes in Municipal Waste - Hazardous waste regulations -minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste - collection and transport.

UNIT- IV:

Hazardous waste management: Treatment technologies –physical, chemical and biological treatment, Hazardous waste landfills: Site selection, remediation of hazardous waste disposal sites-quantitative risk

assessment, containment, remedial alternatives.

UNIT- V:
Environmental regulations: Environmental audit, Pollution Prevention, Facility Development and operation. Hazardous waste – legislation – RCRA process – super fund process – toxicological principles – dose response – toxic effects – toxic response.

Text Books:

1. Peavy, Howard S; Rowe, Donald R; Tchobanoglous, George. "Environmental engineering", First Edition (2017), McGraw Hill Education.
2. Tchobanoglous," Integrated Solid Waste Management", Mc-Graw Hill International 1st Edition, New York, 2014.

Suggested Reading:

1. CPHEEO, "Manualon Municipal Solidwaste management", Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
2. P. A. Vesilind, Worrell W and Reinhart, "Solid Waste Engineering", 2nd Edition (2016), Cengage Learning India Pvt. Ltd.
3. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans, "Hazardous waste Management", Waveland Pr. Inc, 2010

E Resources:

1. https://archive.nptel.ac.in/courses/105/106/105106056/
2. https://archive.nptel.ac.in/courses/105/103/105103205/

22CE E10

RIVER ENGINEERING

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

Course Objectives: To enable the students to

1. To understand River morphology
2. To understand River aggradation and degradation
3. To understand River flow hydraulics
4. To understand Hydraulic geometry of river, river protection and training works
5. To understand Methods of river training and river bank protection

Course Outcomes: On completion of the course, students will be able to

1. Understand about river morphology
2. Apply knowledge on river aggradation and degradation
3. Evaluate different models of river flow hydraulics
4. Analyse hydraulic geometry and execute river protection, training works
5. Design river training and river bank protection

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	1	3	3
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	1	1	3	3

UNIT- I:

River morphology: Behavior of river flow, role of sediments in rivers, changes in regimes. Sediment transport mechanics - bed forms, bed load transport, transport of suspended sediment, critical shear stress, and sediment transport equations.

UNIT- II:

Aggradation and Degradation: Local scour at bridge piers and other hydraulic structures, measurements in rivers - stage measurements, channel geometry, discharge, and sediment samplers and suspended and bed load measurement.

UNIT- III:

Hydraulic modelling of rivers: Hydraulic similitude, physical river models-fixed and movable bed models, sectional models, distorted models, and mathematical models.

UNIT- IV:

River Protection and Training Works: Introduction, classification of river training, types of training works, protection for revetments, dikes, gabions, spurs, bank protective measures and bed control structures.

UNIT- V:

Design of river flood protection structures: Diversion and Cofferdams; River regulations systems; Dredging and Disposal, River restoration.

Text Books:

1. P. Y. Julien, "River Mechanics", *Cambridge University Press*, March 2018, 2nd edition.
2. S. K. Garg, "River Engineering*", Khanna Publishing House*, Delhi, 2021, 1st edition.

Reference Books:

1. Pierre Y. Julien, "Erosion and Sedimentation", *Cambridge University Press*, 2010, updated edition.
2. U. S. Army Corps of Engineers, "River Hydraulics", *University Press of the Pacific*, 2004.
3. Michael J. Kirkby, Stephen 1. Trudgill, "Earth Surface Processes*", John Wiley & Sons*, 1979, 2nd edition.

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc23_ce68/preview
2. https://archive.nptel.ac.in/courses/105/103/105103204/
3. https://www.mooc-list.com/course/room-rivers-perspectives-river-basin-management-edx
4. https://www.mindluster.com/certificate/10179/River-Engineering

Self-Learning Exercises:

1. https://www.sciencebuddies.org/stem-activities/build-river-model

22CE E11

URBAN TRANSPORTATION PLANNING

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: To enable the students to

1. Develop a comprehensive understanding of foundational concepts in the principles of forecasting and planning transportation infrastructure facilities.
2. Acquire practical skills in collecting and analyzing traffic-related data to develop accurate transport demand models.
3. Gain proficiency in utilizing four-stage travel demand modeling methods for transportation planning.
4. Develop the ability to analyze transportation data with precision and proficiency.
5. Learn to evaluate highway projects using a range of economic methodologies.

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

1) Outline the concepts of forecast and planning the transportation facilities.
2) Appraise data collection methodologies and data demand for travel demand modelling.
3) Utilize four-stage transportation demand modelling methods to provide insights into travel patterns.
4) Analyze transportation data and propose solutions to transportation planning problems with precision.
5) Evaluate highway projects using various economic methodologies.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	0	-	-	-	-	-	-	-	-	0	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	0	1	-	-
CO3	3	1	0	-	-	-	-	-	-	-	-	0	1	3	3
CO4	3	2	2	-	-	-	-	-	-	-	-	1	1	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	1	1	3	3

UNIT - I:
Introduction of concepts of Transportation planning process, Interdependence of the land use and traffic, systems approach to transportation planning, stages in transportation planning, survey and analysis of existing conditions, forecast analysis of future conditions and plan synthesis, evaluation, program adoption and implementation.

UNIT - II:
Transportation Surveys – Introduction, definition of the study area, zoning, types of surveys, home interview, commercial vehicle, taxis, roadside interview, registration number of vehicle plate, tags on vehicles, mass transport, and analyzing the data from samples.

UNIT - III:
Trip Generation – Introduction and definition, trip purpose, factors governing trip production and attraction rates, regression methods – multiple linear regression analysis. Trip Distribution – concepts of trip distribution, methods of trip distribution, uniform (constant) factor method, average factor method, Fratar method, Furness method, advantages and disadvantages of growth factor methods, the gravity model.

UNIT - IV:
Modal split – General considerations, factors affecting modal split, modal split in the transportation planning process. Traffic Assignment – purpose of traffic assignment, general principles, assignment techniques, all or nothing assignment, multiple route assignment, capacity restraint assignment, diversion curves.

UNIT - V: Economic evaluation of highway projects – need, basics principles, methods - benefit cost ratio, net

present value, First year rate of return and internal rate of return - comparison. Computer applications in Transportation planning.

Text books:

1. Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2024 - Reprint.
2. Michael D. Meyer and Eric J. Miller, Urban Transportation Planning: A Decision-Oriented Approach (2nd edition), Osgoode Course Casebooks. 73, 2016.

Suggested Reading:

1. B. G. Hutchinson, “Principles of Urban Transport Systems Planning”, McGraw –Hill, Newyork, 1974.
2. C. S. Papacostasand, P. D. Prevedouros, “Transportation Engineering and Planning”, Pearson education India, 2015.
3. L.R. Kadiyali “Traffic Engineering and Transportation Planning” Khanna Publishers, 2011.

E Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105208/
2. https://archive.nptel.ac.in/courses/105/107/105107067/

22CE E12

BASICS OF EARTHQUAKE ENGINEERING

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: To enable the student to

1. Understand the causes of earthquakes, their Magnitude & effects and various types of earthquake waves.
2. Understand the concepts of damped and un damped vibrations and the response of single, two and multi-degree systems to these vibrations, and concepts of Response spectrum.
3. Review various case studies of past earthquakes, and performance of buildings during those earthquakes, understand the concepts of Seismic Design Philosophy and Earthquake Resistant Design of Masonry, RC and Steel structure.
4. Gain knowledge of Seismic Performance of Engineered and Non-Engineered Urban and Rural buildings.
5. Understand the basic concepts of Seismic resistant construction, Base isolation techniques and other energy dissipation devices and Concepts of Seismic retrofitting.

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

1. Apply the fundamentals of engineering seismology; classify the characteristics and effects of strongmotion earthquakes
2. Develop the concepts of damped and un-damped vibrations in single and multi-degrees of freedom systems.
3. Estimate the seismic loads on structures and analyse using seismic coefficient and response spectrum methods
4. Examine the causes of damages of urban and rural buildings and interpret the design provisions from IS-1893 part - I (2016) and IS - 13920(2016).
5. Asses the use of various earthquake resistant devices; apply suitable construction techniques for retrofitting.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	1	2	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	1	2	-	3
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-	3
CO4	2	2	3	-	-	-	-	-	-	-	-	1	2	-	3
CO5	2	2	3	-	-	-	-	-	-	-	-	1	2	-	3

UNIT – I:

Engineering Seismology& Elements: Causes of Earthquakes–Geological faults, Tectonic Plate theory – Elastic Rebound theory –Focus - Epicenter – Hypocenter, Seismic waves –Primary and Secondary waves, Seismogram -Magnitude, Intensity and Energy release during earthquakes – Magnitude & Intensity Scales, Characteristics of strong earthquake ground motions – Effect of soil properties – Liquefaction of soils.

UNIT – II:

Theory of Vibrations: Introduction to Vibrating Systems – mass, stiffness and damping parameters – Concept of inertia, elastic restoring force and damping –types of damping, difference between static forces and dynamic excitation.

Single Degree of Freedom (SDOF) Systems – SDOF idealization - Formulation of Equation of motion(for mass as well as base excitation) and response for free, damped & undamped vibrations.

Multi Degree of Freedom (MDOF) Systems - Equation of Motion–undamped free vibration, Modal Analysis - Natural frequencies - generation of modal frequencies and mode shapes, Construction of Response Spectrum.

UNIT – III:

Estimation of Seismic Loads on Structures: –Determination of earthquake forces on structures – Seismic Co-efficient and Response Spectrum Methods. Response Reduction factor - Concepts of over strength, Ductility and Redundancy.

UNIT – IV:

Seismic Performance of Buildings: Case Studies of damages to urban and rural buildings during some past earthquakes – Damage Patterns in structural and non –structural elements – Soft storey effect, Ductile detailing as per IS – 13920(2016).

UNIT – V:

Earthquake Resistant Devices &Construction Techniques: Vibration Control Devices - Base isolators, Energy dissipating devices – Dampers, Lateral Displacement Control - Bracing Systems, Shear Walls.

Seismic Retrofitting: Principles of repair, rehabilitation and retrofitting. Retrofitting Techniques for RCC and Masonry buildings

Text Books:

1. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall ofIndia Pvt.Ltd, 2011.
2. S.K Duggal, "Earthquake Resistant Design of Structures", Oxford Higher Education, Second Edition, 2013.

Suggested Readings:

1. A.K. Chopra, "Dynamics of Structures", Pearson Education, Fifth Edition, 2017.
2. Jai Krishna, A.R Chandra sekaran, Brijesh Chandra, "Elements of Earthquake Engineering", South AsianPublishers Pvt. Ltd, Second Edition, 2014.
3. Steven L Kramer, "Geo-Technical Earthquake Engineering", Pearson Education Ltd, 2013.

E Resources:

1. https://archive.nptel.ac.in/courses/105/101/105101004/
2. https://archive.nptel.ac.in/courses/105/108/105108204/

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2023-24

BE (Civil Engineering)

SEMESTER – VII:

Sl No	Course code	Title of the Course	Scheme of instruction Hours per week			Scheme of Examination			Credits
			L	T	P	Duration of SEE in hours	Max marks CIE	Max marks SEE	
1	22CE C30	Construction Engineering and Management	3	-	-	3	40	60	3
3	22MB C01	Engineering Economics and Accountancy	3	-	-	3	40	60	3
4	-	PE -4	3	-	-	3	40	60	3
5	-	PE – 5	3	-	-	3	40	60	3
6	-	OE – 3	3	-	-	3	40	60	3
7	22CE C31	Concrete Technology Lab	-	-	3	3	50	50	1.5
8	22CE C32	Computer Applications Lab	-	-	3	3	50	50	1.5
10	22CE C33	Project Part -1	-	-	4	-	50	-	2
		Total	**15**	**-**	**10**	**-**	**350**	**400**	**20**
	Clock Hours per week: 25								

*Data Analytics and Visualization lab for Civil Engineers- Offered as Value Added Course

L: Lecture T: Tutorial P: Practical/Drawing/Seminar/Project

CIE: Continuous Internal Evaluation SEE: Semester End Examination

Professional Electives-4 (PE-4)

22CE E13	Foundation Engineering
22CE E14	Finite Element Methods
22CE E15	Design of Hydraulic Structures
22CE E16	Contaminant Transport Modelling

Professional Electives-5 (PE-5)

22 CE E17	Railway and Airport Engineering
22CE E18	Repair and Rehabilitation of Structures
22CE E19	Design of Steel Structures -II
22CE E20	Rural Water Supply and Onsite Sanitation Systems

Open Electives – 3 (OE-3)

22CAO01	Foundations of Artificial Intelligence and Machine Learning
22EGO03	Indian Traditional Knowledge
22CI O01	Fundamentals of IoT
22ADO02	Data Science using Python

22CE C30

CONSTRUCTION ENGINEERING AND MANAGEMENT

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: To enable the students to

1. Understand different types of construction, execution methods and basics of construction project management.
2. Develop knowledge in respect of project planning and application of different techniques for project planning and control.
3. Analyze the projects in respect of time and cost to result in resource optimization.
4. Understand the various construction safety measures and quality management systems applicable for construction projects.
5. Distinguish various construction equipment used and understand essential contracting systems adopted in construction industry

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

1. Outline different types of project delivery methods and organization types for construction Projects.
2. Illustrate various scheduling techniques and calculate the project durations.
3. Determine optimized project duration and cost using time cost trade-off technique.
4. Explain construction safety measures and quality management systems.
5. Demonstrate various construction equipments and types of contracts, tendering processes.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-		-	2	-	-	3	-	2	-	3
CO2	2	3	-	-	-		-	-	-	-	3	-	2	-	3
CO3	2	3	-	-	-		-	-	-	-	3	-	2	-	3
CO4	2	2	-	-	-	3	-	-	-	-	3	2	2	-	3
CO5	2	2	-	-	-	3	-	2	-	-	3	2	2	-	3

UNIT-I:

Introduction to Construction and Construction Management: Construction and unique features of construction, construction projects-types and features, phases of a construction project, agencies involved and their methods of execution- Project Delivery Methods: BOT, SBOO, BOOT; Public Private Partnership (PPP); Significance of construction management, Construction Team. Organization – principles and types.

UNIT-II:

Construction project planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, Types of Project plans- Time plan, man power plan, material plan, construction equipment plan; Work break-down structure- Techniques of planning- Bar charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths. PERT- Assumptions underlying PERT analysis.

UNIT-III:

Project Monitoring & Control: Introduction – Supervision, record keeping, periodic progress reports. Updating of plans: purpose, frequency and methods of updating- using bar charts, PERT/CPM, Resource Levelling and Precedence network. Schedule/time progress control; Cost control- Classification of costs, time-cost trade-off in construction projects.

UNIT-IV:

Construction Safety and Quality Management Safety: Significance of construction Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health; Quality control: construction quality, Quality control and Quality Assurance in construction projects, ISO Standards-Benefits of ISO 9000, Principles of quality management systems, ISO 9000 -2000 family of Standards.

UNIT-V:

Construction Equipment and Contracts: Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials.

Contracts**:** Introduction, types of construction contracts and their advantages and disadvantages, conditions of contracts, Tender: Tender form, Tender Documents, Tender Notice, Work Order. Delays, penalties and liquid4.ated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.

Text Books:

1. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.
2. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Reference Books:

1. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
2. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006.
3. Angerame, Mike. Engineering & construction project management. Denver, Colo: Hampton Group, 2002.

E-Resources:

1. https://archive.nptel.ac.in/courses/105/104/105104161/.
2. https://archive.nptel.ac.in/courses/110/104/110104073/

22MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

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: The Objectives of the Course are:

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

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

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	3	1	1	1	1	1	1	1	-	-	1	-	1
CO2	2	2	2	2	-	1	1	1	-	1	-	1	2	1	2
CO3	1	2	1	2	2	-	2	1	-	1	-	-	1	2	2
CO4	2	2	1	2	2	1	1	3	-	1	-	-	-	-	1
CO5	1	3	1	2	1	1	2	-	-	1	2	1	2	1	2

UNIT-I

Introduction to Managerial Economics

Introduction to Economics and its evolution – Managerial Economics – its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics – Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

UNIT-II

Demand and Supply Analysis

Demand Analysis – Concept of Demand, Determinants, Law of demand – Assumptions and Exceptions; Elasticity of demand – Price, Income and Cross elasticity – simple numerical problems; Concept of Supply – Determinants of Supply, Law of Supply; Demand Forecasting – Methods.

UNIT-III

Production and Cost Analysis

Theory of Production – Production function – Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.

Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

UNIT-IV

Accountancy

Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

UNIT-V

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods – Numerical problems.

Text Books:

1. Mehta P.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.

Suggested Readings:

1. Panday I.M. "Financial Management", 11th edition, Vikas Publishing House, 2015.
2. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
3. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.

E Resources:

1. https://nptel.ac.in/courses/112107209
2. https://archive.nptel.ac.in/courses/105/104/105104178/

22CE C31

CONCRETE TECHNOLOGY LAB

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: To enable the students

1. Understand the behaviour of cement by conducting various tests on cement.
2. Understand the behaviour of Aggregates by conducting various tests on Fine Aggregate and Coarse Aggregate.
3. Understand the behaviour of concrete by conducting various tests on concrete in fresh and hardened states.

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

1. Determine the properties of given cement sample and assess its suitability for use in construction.
2. Evaluate the properties of fine and coarse aggregate samples to assess their suitability for use inconstruction works.
3. Measure the workability of concrete and recommend its suitability for structural works.
4. Design a suitable concrete mix proportion as per the code provisions for the specified grade.
5. Conduct destructive and non-destructive tests to evaluate the quality and strength of concrete.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	2	2	-	3	-	-	-	-	1	-	-	-	2	-	3
CO2	2	2	-	3	-	-	-	-	1	-	-	-	2	-	3
CO3	2	2	-	3	-	-	-	-	1	-	-	-	2	-	3
CO4	2	2	3	3	-	-	-	3	1	-	-	2	2	-	3
CO5	2	2	-	3	-	-	-	-	1	-	-	-	2	-	3

List of Experiments:

1) Determination of the specific gravity of the given cement sample
2) Determination of the standard consistency of the given cement sample
3) Determination of the initial setting time of the given cement sample
4) Determination of the bulking of Fine Aggregate
5) Determination of the bulk density, void ratio, porosity and specific gravity of given Fine and coarseAggregate
6) Determination of the fineness modulus of Fine Aggregate & Coarse Aggregate
7) Determination of the slump & compaction factor of concrete mix
8) Determination of the compressive strength of concrete cubes and split tensile strength of concrete cylinders
9) Mix design as per IS:10262-2019
10) Demonstration of Non-destructive testing of concrete specimen

Reference books:

1. M.S. Shetty, “Concrete Technology-Theory & Practice”, S. Chand &Company Publishers.
2. IS10262:2019, “Indian Standard Concrete Mix Proportioning–Guidelines”.

E Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102012/
2. https://archive.nptel.ac.in/courses/105/104/105104030/

22CE C32

COMPUTER APPLICATIONS LAB

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: To enable the students

1. To understand about the computer applications fundamentals, and its applications to engineering problems.
2. To enable the students to formulate the design problems using computer applications.
3. To learn the programming of numerical methods of various Civil Engineering domains.
4. To understand the computing techniques in the field of Civil Engineering.
5. To study the different software packages for analysis and design.

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

1. Develop a model of framed structure and analyze using STAAD Pro.
2. Design the structural components of a framed RC structure using STAAD Pro.
3. Design of isolated footings using STAAD Foundation.
4. Evaluate stability of slope using Slip Circle method and design a cantilever retaining wall using GEO5.
5. Analyze pipe networks using EPANET.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	3	-	-	-	-	1	-	-	-	2	3	-
CO2	2	2	3	3	-	-	-	-	1	-	-	-	2	3	2
CO3	2	2	3	3	-	-	-	-	1	-	-	-	2	3	2
CO4	2	2	-	3	2	-	-	-	1	-	-	1	2	3	2
CO5	2	3	-	3	2	-	-	-	1	-	-	1	2	3	2

List of Exercises:

1. Modelling and analysis of simple beams with different Loadings using STAAD Pro.
2. Modelling and analysis of continuous beams with different Loadings using STAAD Pro.
3. Modelling and analysis of plane frames for static loads using STAAD Pro.
4. Modelling and analysis of space frames for static loads using STAAD Pro.
5. Modelling and analysis of space frames for lateral loads using STAAD Pro.
6. Design structural components of a RC building using STAAD Pro.
7. Design of isolated footing using STAAD Foundation.
8. Analysis of slope stability by Slip Circle method using GEO5 (Slope Stability module)
9. Design of cantilever retaining wall using GEO5 (Cantilever Wall module)
10. Steady state analysis of pipe networks (open/looped) using EPANET
11. Digitization of topo sheets using GIS.
12. Map overlay using GIS.

References:

1. STAAD Pro V8i (SELECT Series 4) manual on staad exercise, July, 2019
2. EPANET 2 User's Manual Paperback – Import, 30 January 2013 by U S Environmental Protection Agency (Creator)
3. Design of Sewer Network using Sewer GEMS Software Paperback – September 17, 2018 by Hinal Sopariya (Author)

E Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102015/
2. https://www.vlab.co.in/ba-nptel-labs-civil-engineering

22CE C33

PROJECT PART-I

Instruction	4L Hours per week
Duration of Semester End Examination	Hours
Semester End Examination	Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Objectives: The students enable to

1. Survey and study of published literature on the assigned topic
2. Working out a preliminary Approach to the Problem relating to the assigned topic
3. Conducting preliminary Analysis/Modeling/Simulation/Experiment/ Design/Feasibility
4. Preparing a Written Report on the Study conducted for Presentation to the Department
5. Final Seminar, as oral Presentation before a departmental Committee.

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

1. Identify their domain interest through critical review of literature.
2. Develop the technical skill in preparing a well-structured report on the chosen topic.
3. Develop the skill of presenting a structured seminar using Power Point presentation tools.
4. Improve communication skills.
5. Defend one's presentation by interactions with the participants.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO2	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO3	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO4	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO5	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field of choice.
2. Literature review and critical appraisal.
3. Consolidation and summarization of available information.
4. Conclusions.
5. References

Each student is required to:

1. Submit a one page synopsis on the seminar topic.
2. Make Power Point presentation on the chosen topic for 20 minutes duration, followed by 10 minutes ofinteraction with participants during Question and Answers session.
3. Submit a spiral bound copy of detailed report on the seminar topic in the format as prescribed by thedepartment.

For the award of CIE marks, students are judged by a committee of three (3) faculty members based on oral and written presentations as well as their interactions during Question-Answer session.

Guidelines for awarding marks		
Sl. No.	**Description**	**Maximum Marks**
1	Contemporary relevance of topic and Content.	10
2	Preparation of PPT slides	05
3	Presentation skills	10
4	Answering to the questions	05
5	Report preparation in a prescribed format	20

Note: Material for the seminar, on the chosen topic, shall be prepared preferably from the recently publishedpeer reviewed journal papers.

22CE E13

FOUNDATION ENGINEERING

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: To enable the students to

1. Understand the stress distribution in the soils for different loading conditions
2. Understand the principle of bearing capacity and settlement analysis.
3. Understand the principles of single and group piles.
4. Select suitable methods for the construction of coffer dams and caissons.
5. Understand the principles of site investigation techniques and timbering of excavations.

Course outcomes: At the end of the course the students should be able to

1. Compute the stress distribution in the soil deposit for different loading conditions.
2. Estimate the bearing capacity of different soils for shallow foundation.
3. Design the load carrying capacity of deep foundation.
4. Interpret and implement the concepts of Coffer dams and Caissons.
5. Deal with the field investigations, sampling methods and Timbering of Excavations

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	3	-	-	-	-	-	-	-	-	-	-	2	-	3
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	-	3
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2	-	3
CO5	2	3	-	-	-	-	-	-	-	-	-	-	2	-	3

UNIT- I:

Stress distribution in Soils: Boussinesq's and Westergaards equations for point load. Application of point load formulae for uniformly distributed load on circular area, Line load, Strip Load, rectangular area. Use of Newmark's chart for different areas using Boussinesq's equation and Contact pressure distribution.

UNIT- II:

Bearing capacity of soils: Terzaghi's equation for bearing capacity in soils for square, rectangular and circular footings, general and local shear failure conditions. Plate load test as per IS specification. Allowable bearing capacity. Standard penetration test and use of N values for estimating soil conditions and bearing capacity.

Settlement Analysis: Computation of pressures before loading and after loading. Estimation of settlement – ultimate and after any given period.

UNIT- III:

Pile Foundations: Types of piles–Timber, steel, concrete, casret-in situ, precast piles, bearing piles, friction piles, compaction piles, large diameter piles. Pile capacity – Static formulae, dynamic formulae, pile load test, determination of point resistance and skin friction as per IS code. Bearing capacity of pile groups and negative skinfriction.

UNIT- IV:

Caissons: types of caissons–Open caissons, pneumatic caissons, box caissons (floating caissons). General description and construction methods. Dewatering techniques: sumps, ditches. Well points, deep walls.

Geotextile methods: Types and uses.

Coffer dams: Earth embankments, cantilever sheet piles, braced coffer dams. Double wall cofferdams, cellular coffer dams – circular, diaphragm type, general description and construction methods.

Machine foundations: Types, Basic definitions. Degree of Freedom of a Block foundation, General criteria for design of machine foundation, Free and forced Vibration.

UNIT- V:

Site investigation: Principles of exploration, sampling methods, transportation and storage of samples, boring and drilling methods, log of bore holes, sampling tubes and samplers. Sampling records.

Timbering of excavation: Bracing for shallow and deep excavations. Computation of lateral earth pressure. Reaction of struts.

Text Books:

1. K. R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist.; 7th Edition, 2008
2. Gopal Ranjan and A S R Rao "Basic and Applied Soil Mechanics", New Age International Pvt Ltd; Third Edition 2016.

Suggested Reading:

1. B. M. Das and K. Sobhan, "Principles of Geotechnical Engineering", 9th edition, 2018
2. E. J. Bowles, "Foundation Analysis and Design", Tata Mc Graw Hill, 2017.
3. Handy, Richard L. 2020. Foundation Engineering: Geotechnical Principles and Practical Applications. 1st ed. New York: McGraw-Hill Education.

E Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105176/
2. https://archive.nptel.ac.in/courses/105/107/105107120/

22CE E14

FINITE ELEMENT METHODS

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: To enable the students to

1. Learn the fundamentals of Finite element method (FEM) and derive elasticity matrices for 2- D, 3-D and axisymmetric elasticity problems.
2. Understand basic principles of minimum potential energy methods, Principle of virtual work and various coordinate systems
3. Understand the FEM formulation for bar, truss elements and analyze simple problems with kinematic indeterminacy not greater than three.
4. Understand the FEM formulation for beam element and rigid jointed plane frame element and analyze simple problems with kinematic indeterminacy not exceeding than three.
5. Get familiarized with displacement models, Iso-parametric elements, 2D CST elements and rectangular elements and know the formulation of global stiffness matrices and load matrices and Gauss Quadrature rule

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

1. Apply the fundamentals of FEM, elements of theory of elasticity for 2D, 3D and axisymmetric problems.
2. Apply Principle of minimum potential energy and Principle of Virtual work; analyze simple problems using Rayleigh Ritz Method and Galerkin's method.
3. Formulate the local and global stiffness matrix, load matrix for 1D bar elements and 2D truss elementsand analyze simple problems.
4. Develop the stiffness matrix for beams and rigid jointed plane frames and solve problems with degree offreedom not exceeding three.
5. Select displacement functions, formulate the stiffness matrix, load matrix for CST elements. UseIso-parametric elements and quadrilateral elements, and evaluate definite integral by Gauss Quadrature.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	1	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	1	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	3	3	-
CO4	2	2	3	-	-	-	-	-	-	-	-	1	3	3	-
CO5	2	2	3	-	-	-	-	-	-	-	-	1	3	3	-

UNIT- I:

Introduction to FEM: General description of the method, brief history of the method, applications of the method, advantages of the finite element method, steps in the finite element method. Types of elements, Types of forces, and Boundary conditions. Strain displacement, and stress- strain relations for 2-D, 3-D problems & Axisymmetric elements. Equations of equilibrium and compatibility conditions for 2-D and 3-D problems. Plane stress and plane strain situations and derivation of elasticity matrices.

UNIT- II:

Finite Element Formulation: Principle of minimum potential energy, Principle of virtual displacement, Raleigh Ritz method, Weighted Residual method- Galerkin's method. Coordinate system - Global coordinate, local coordinate and natural coordinate system.

UNIT- III:

Bar Elements: Shape functions, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads, surface forces and body forces - constant cross section and varying cross section bar.

Truss Elements: Transformation matrix, Stiffness matrix of truss member in local and global coordinates, analysis of trusses with kinematic indeterminacy not exceeding three.

UNIT- IV

Beam Elements: Shape functions, beam element stiffness matrix, element load vector, and analysis of continuous beams with kinematic indeterminacy not exceeding three. Plane Frame elements: Element stiffness matrix in local coordinates, Transformation or Rotation matrix, and stiffness matrix and load vector in global coordinates.

UNIT-V:

Displacement models: Selection of displacement models, geometric invariance, conforming and non-conforming elements. Triangular Elements (CST) and Rectangular Elements: Determination of strain-displacement matrix, shape functions, determination of element stiffness and load matrices, assembling global stiffness and load matrices.

Iso-parametric elements: Iso-parametric concept, Iso-parametric, Sub parametric and Super parametric elements. Gauss Quadrature of numerical integration.

Text Books:

1. David V. Hutton, “Fundamentals of Finite Element Analysis”, McGraw Hill Education (India) Private Limited, Delhi, 2014.
2. P. N. God bole,” Introduction to Finite Element Method”, I. K. International Publishing House Pvt. Ltd. New Delhi, 2013.

Suggested Reading:

1. T. R. Chandrupatla and A. D Belegundu, “Introduction to Finite Elements in Engineering”, Prentice – Hallof India Private Limited, New Delhi, 2009
2. Daryl L, Logan, “A first course in the Finite Element Method”, Third Edition, Thomson Brook, Canada Limited, 2007.
3. O. C. Zienkiewicz and R. Taylor, “The Finite Element Method”, Vol.1, McGraw Hill Company Limited, London, 1989.

E Resources:

1. https://archive.nptel.ac.in/courses/112/104/112104193/
2. https://onlinecourses.nptel.ac.in/noc22_me43/preview

22CE E15

DESIGN OF HYDRAULIC STRUCTURES

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: To enable students to

1. Principles and design of surplus weir.
2. Functioning of sluice, design of various components.
3. Types of canal falls, basic principles of glacis type canal drop and its design.
4. Basic principles of Design of Cross regulator and its design.
5. Design of spillways.

Course Outcomes: on completion of the course, students will be able to

1. Analyze the components of surplus weir.
2. Illustrate various components of the Canal.
3. Classify different types of Canal falls.
4. Design of cross regulator.
5. Design of spillways and energy dissipators.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	1	-	-	-	-	-	1	1		3
CO2	3	2	2	-	-	1	-	-	-	-	-	1	1	--	3
CO3	3	2	2	-	-	1	-	-	-	-	-	1	1	-	3
CO4	3	2	2	-	-	1	-	-	-	-	-	1	1	-	3
CO5	3	2	2	-	-	1	-	-	-	-	-	1	1	-	3

UNIT - I:

Surplus weir: types of weirs, components of diversion head works, crest level of weir, afflux, design of surplus weir, design for surface flow and sub - surface flow, length, level and thickness of downstream apron, upstream and downstream cut-offs, protection works.

UNIT- II:

Direct Sluice: -Hydraulic particulars of mail canal and distributary, general arrangements of various components- Design of vent way, Wing Walls and return walls.

UNIT- III:

Canal Falls: Definition, types of falls.

Glacis type Canal Drop: Components, General arrangements, Fluming ratio, fixing the crest level, length of weir, U/S and D/S glacis, Transitions - Protection works -Curtain wall, Energy dissipation arrangements.

UNIT- IV:

Cross Regulator: General design principles - General arrangements of various components - design of vent way by drowning ratio - arrangements of energy dissipation - U/S & D/S protection works.

UNIT- V:

Spillways: Spillways, Ogee spillway and design of its components. Design of Energy Dissipation structures, Bucket type.

Text Books:

1. B.C. Punmia, B.C. Punmia, B.B. Lal, Ashok Kr. Jain, Arun Kr. Jain "*Irrigation & Water Power Engineering*", Lakshmi Publications, Delhi, 2017, 16th Edition.
2. Ch. S. N. Murthy, "*Water Resources Engineering: Principles and Practice", New* Age International Publishers, Delhi, 2002, 2nd Edition, reprint 2011.

Suggested Reading:

1. R S Varshney, S C Gupta, R L Gupta, "*Theory & Design Of Irrigation Structures Vol. 1*", Nem Chand & Brothers, 2009, 7th Edition.
2. S. K. Garg, "*Irrigation Engineering and Hydraulic Structures-Water Resources Engineering (Vol II)"*, Khanna Publishers, New Delhi, 2017, 34th Edition.
3. Sharma, S. K. *Irrigation Engineering and Hydraulic Structures*. S. Chand Publishing, 2017, 1st Edition.

E-resources:

1. https://archive.nptel.ac.in/courses/105/105/105105110/tructures
2. https://archive.nptel.ac.in/courses/105/106/105106114/

22CE E16

CONTAMINANT TRANSPORT MODELLING

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: To enable the students to

1. Understand the fundamental concepts of contaminant pollution
2. Acquire the knowledge on modelling and mathematical techniques
3. Apply numerical and computational concepts for the contaminant transport modelling
4. Analyze the importance of different modelling processes in model development
5. Evaluate the model simulations on air and water pollution monitoring

Course Outcomes: on completion of the course, students will be able to

1. Demonstrate comprehensive knowledge on fate and transport of contaminant through different phenomenon.
2. Develop an idea to apply fundamental principles in contaminant transport modelling.
3. Analyze the role of model constraints on efficacy of pollutant simulations
4. Evaluate the performance of different model approaches of water and air pollutants.
5. Apply the model simulation knowledge on computing the ideal tracer transport in a soil or air medium.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	2	-	-	-	-	-	3	-	2
CO2	3	2	2	-	-	-	2	-	-	-	-	-	3	-	2
CO3	2	3	2	-	-	-	2	-	-	-	-	-	3	-	2
CO4	2	3	3	1	-	-	2	-	-	-	-	1	3	-	2
CO5	2	2	3	1	1	-	3	-	-	-	-	1	3	-	2

UNIT-I:

Introduction to contaminant transport modelling; Conservation laws: Systems approach, Control volume approach and Differential element approach; Continua; Source, Sinks and Reactions; Box models.

UNIT-II:

Particles behaviour in fluid media: Particle in suspension, Interaction of particles surface with liquid or gaseous pollutants: Settling, Sedimentation, Coagulation, Adsorption and absorption. Stoke's law of settling: particle settling in -water and -air media. Adsorption at soild-liquid and solid-gas interfaces, Adsorption Isotherms: Longmuir and Freundlich isotherms

UNIT-III:

Transport phenomenon: advection, diffusion, dispersion; conservative and non-conservative pollutants. Fick's law of diffusion: I & II law; Governing Equations for flow and transport in surface and subsurface waters - chemical and biological process models - simplified models for lakes, streams, and estuaries, Turbulent diffusion models: Eulerian and Lagrangian Approach; Indoor air quality models.

UNIT-IV:

Model Simulations: Model complexity, model resolution, coupled and uncoupled models; linear and nonlinear models; Solution techniques: Model input parameters, Initial and boundary conditions, calibration, sensitivity analysis; application and evaluation of environmental control; bioremediation.

UNIT-V:

Numerical & Computational models: FDM, explicit vs. implicit methods, numerical errors, High resolution techniques; Finite volume techniques; Stream quality modelling using QUAL2K; Groundwater transport modelling using VISUAL MODFLOW; Computational models: Global and regional climate models Reg-Chem & WRF-Chem and Indoor air quality models IAQx.

Text Book:

1. Mark M. Clark, Transport Modeling for environmental engineering and scientists, A John wiley & sons, inc, publication, Newyork, 1996.
2. Dunnivant, F. M., & Anders, E. (2006). A basic introduction to pollutant fate and transport: an integrated approach with chemistry, modeling, risk assessment, and environmental legislation. John Wiley & Sons.

Reference Books:

1. Zheng, C. and Bennett, G. D., Applied contaminant Transport Modeling, A John wiley & sons, inc, publication, Newyork, 2002.
2. Martin, L.J. and McCucheon, S.C, *Hydrodynamics of transport for water quality modeling*, Lewis Publishers, Boca Raton, 1999.
3. Sun, N. Z., Mathematical modeling of groundwater Pollution, Springer –Verlac Newyork Inc., and Geological publishing house, 1996.

E Resources:

1. http://acl.digimat.in/nptel/courses/video/105101200/L40.html
2. https://nptel.ac.in/courses/111105099

22CE E17

RAILWAY AND AIRPORT ENGINEERING

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: To enable the students

1. To impart fundamental knowledge about various components of permanent way.
2. To make capable of designing a permanent way as per IRC guidelines.
3. To impart fundamental knowledge about knowledge for construction and maintenance of the railway track.
4. To make capable of explaining the structure of airport system, components of aircraft.
5. To make capable of planning an airports and facilities as per international ICAO standards.

Course outcomes: At the end of the course, the students will be able to:

1. Outline the role played by various components of permanent way
2. Understand the importance of points and crossings and design a permanent way as per IRC guidelines
3. Make use of the knowledge for construction and maintenance of the railway track.
4. Explain the structure of airport system, components of aircraft
5. Plan airports and facilities as per international ICAO standards.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	-	3
CO3	2	-	-	-	1	-	-	-	-	-	1	-	2	-	3
CO4	2	-	-	-	-	-	-	-	-	-	1	-	2	-	3
CO5	2	1	1	-	-	-	-	-	-	-	-	-	2	-	3

UNIT-I:

Introduction of railway engineering: History of development of railway engineering, brief introduction of railway zones, classification of Indian railway, Permanent way – rail gauges – types, uni-gauge policy, ideal requirements, Rails, types of rails, rail fastenings, rail joints creep – causes, measurement, remedial measures for rectification of creep, adzing of rails. Sleepers – function of sleepers, requirements of sleepers, sleeper density, types of sleepers. Ballast-functions of ballasts, requirements of ballasts, screening of ballasts, size and quantity of rail ballasts.

UNIT-II:

Geometric design of track: Curvature of track, designation of curves, types of curves, design of transition curves, cant concept, cant deficiency, cant excess, speeds of trains on curves, types of gradients, and grade compensation.

Points and crossings: Introduction of right- and left-hand turn outs, terms used in points and crossings, components, length of stock rail, heel clearance, Crossings-types of crossings – ordinary and double crossings, theoretical and actual nose of crossings, crossing angle, types of leads calculations, Design and maintenance of points and crossings.

UNIT-III:

Construction and maintenance of railway track: Necessity for maintenance of track, maintenance of track proper, maintenance of railway bridges, maintenance of rolling stock, signaling during maintenance, tools

required during maintenance. Definition of station, selection of site for railway station, features of railway station, Dimensions of platform, definition of a yard, types of yard. Drainage system– Significance of drainage system, requirements of drainage system.

UNIT-IV:

Introduction of air transport system: Roles and responsibilities of director of Civil Aviation and National Airport Authority, International Airport Authority of India, Airports Authority of India, ICAO. Aircraft Characteristics, components of an aircraft. Airport Master Plan – FAA and ICAO recommendations, regional planning, airport site selection, airport location.

UNIT-V:

Airport planning: Typical layout of a terminal areas and airport incorporating airport components – terminal building, apron, hangar, Runway design – runway orientation, wind rose diagrams, basic runway length, connections to runway lengths, airport classifications and airport obstructions.

Airport capacity: Factors influencing runway capacity, methods for practical capacity determination, gateway, capacity, taxiway capacity, airport configuration – single runway, parallel runway, intersecting and non-intersecting runway, taxiway design, factors controlling taxiway layout and geometric design standards, exist taxiways.

Text Books:

1. S.P. Arora, S.C. Saxena, "Railway Engineering", Dhanpat Rai Publications Pvt. Ltd. New Delhi, 8th Edition, Reprint 2021
2. S.C. Rangwala, "Railway Engineering", Charotar Publishing House Pvt. Ltd. 27th Edition, 2017.

Suggested Reading:

1. Satish Chandra, M.M. Agarwal, "Railway Engineering", Oxford, second edition, 2013.
2. R. Srinivasa Kumar, "Airport, Railway, Docks & Harbors". Universities Press, 2014.
3. S. K. Khanna, M. G. Arora, and S. S. Jain, Airport Planning and Design, Nemchanad and Brothers, Roorkee, 6th Edition, 2017

E Resources:

1. https://nptel.ac.in/courses/105107123
2. http://acl.digimat.in/nptel/courses/video/105107123/lec1.pdf

22CE E18

REPAIR AND REHABILITATION OF STRUCTURES

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: To enable the student to

1. Maintenance and causes for distress.
2. Serviceability and durability limits.
3. Importance of structural audit and different NDT techniques.
4. Different repair materials & their suitability.
5. Various repair techniques and rehabilitation methods.

Course outcomes: At the end of the course, the students will be able to:

1. Interpret SHM as a way of monitoring the health of a structure using smart materials.
2. Select and implement an appropriate vibration-based technique for health monitoring of a structure.
3. Select and implement an appropriate capacitive sensing technique.
4. Perform condition assessment survey of damaged/existing buildings and to identify possible defects in a concrete structure and suggest necessary repairs.
5. Implement various health monitoring techniques for different types of structures for different situations.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	1	-	-	-	-	-	2	-	3
CO2	2	3	-	-	-	-	1	-	-	-	-	-	2	-	3
CO3	2	3	-	-	-	-	1	-	-	-	-	-	2	-	3
CO4	2	3	-	-	-	-	1	-	-	-	-	-	2	-	3
CO5	2	3	-	-	-	-	1	-	-	-	-	1	2	-	3

UNIT-I:

Maintenance: Definition for Repair and rehabilitation - Facets of maintenance - Importance of maintenance, Types of Maintenance, various aspects of inspection – Assessment procedure for evaluating damaged structure- Causes of distress in concrete structures – Construction and design failures – Introduction to structural audit.

UNIT-II:

Serviceability and durability of concrete: Quality assurance for concrete construction - Concrete properties – Strength - Permeability – Thermal properties and cracking. – Effects due to climate - Temperature - Chemicals- Corrosion – Design and construction errors – Effects of cover thickness and cracking.

UNIT-III:

Repair materials: Materials and techniques for repair: Special concretes and mortar - Concrete chemicals - Special elements for accelerated strength gain - Expansive cement - Polymer concrete - Sulphur infiltrated concrete - Ferro cement - Fibre reinforced concrete - Bacterial concrete – Rust eliminators and polymers coating for rebars during repair – Foamed concrete - Mortar and dry pack – Vacuum concrete - Gunite and shotcrete - Epoxy injection - Mortar repair for cracks - Shoring and underpinning -Methods of corrosion protection - Corrosion inhibitors – Corrosion resistant steels - Coating and cathodic protection.

UNIT-IV:

Corrosion of embedded steel in concrete: Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns) Local

and Global retrofitting, Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, FRP jacketing. Strengthening Techniques, Beam shear strengthening, Flexural strengthening.

UNIT-V:

Structural Health: Introduction to Structural health Monitoring, Definition and objective of condition survey, stages of conditions survey–planning, inspections and testing stages, possible defects in concrete structures, quality control of concrete structures, NDTtechniques-rebound hammer, infra- red thermography, ground penetration technique, ultra-sonic pulse velocity test and Windsor probe test, half-cell potential test etc,

Text Books:

1) Daniel Balageas and Claus – Peter Fritzen, "*Structural Health Monitoring*", published by ISTELtd.,U.K.2006.
2) V.M. Malhotra, "*InSitu/ Non-destructive Testing of Concrete (Publication, Sp-82)",* published by AmerConcrete Inst 1984.

Suggested Reading:

1) HuaPengChen,"*StructuralHealthmonitoringoflargeengineeringstructures*",publishedbyWiley-Blackwell,2018.
2) "*Guide book on Non-destructive testing of concrete structures*", training course, series no.17,International Atomic Agency, Vienna2002.
3) Jean Paul Balayssac and Vincent Garnier, "*Non-Destructive evaluation and evaluation of civil engineering structures",* Published by ISTEPress–Elsevier,2017.

E Resources:

1. https://archive.nptel.ac.in/courses/105/106/105106202/
2. https://archive.nptel.ac.in/courses/105/105/105105213/

22CE E19

DESIGN OF STEEL STRUCTURES – II

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

Codes required: IS 800 – 2007, steel tables, Bridge rules, Bridge Code (RDSO)

Course Objectives: To enable the students to

1. Gain exposure to a few basic types of steel structures (Plate Girders, Gantry girders, trussed girders etc.) and their components, used in Highway bridges, Industrial workshops and Railway bridges.
2. Attain fundamental knowledge of design of plate girder, gantry girder, steel railway bridges (plate girder & truss girder type), rocker & roller bearings and is able to interpret the specifications of relevant codes.
3. Acquire adequate conceptual knowledge and skills to extend the same to investigate into critical issues, compare various options & choose best solution for the problems in the areas of highway, industrial and railway steel structures
4. Consider economy in the design of these structures without suffering the safety, in a given situation.
5. Understand the intricacies of detailing aspects of these structures and their connections

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

1. Design welded plate girders as per IS 800-2007.
2. Design gantry girder including connections.
3. Identify the suitability of bridge type, Design Roller & Rocker bearings for railway bridges.
4. Design deck type riveted plate girder for railway bridges including wind effects.
5. Design of through type riveted truss girder for railway bridges.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO2	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO3	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO4	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-
CO5	2	2	3	-	-	1	-	1	-	-	-	1	2	3	-

UNIT- I:

Design of Welded Plate girders: Design of welded plate girder for static loads–Economical Depth, Design of Cross Section, Flange curtailment, intermediate and bearing stiffeners, connections- As per IS 800-2007.

UNIT- II:

Design of Gantry girders: Basic principles and applications, Loads, Codal provisions, Gantry girder cross sections, Analysis, Design of Cross section and connections.

UNIT- III:

Introduction to Railway Bridges and Design of bearings: Bridges: Deck and through type bridges – Economical span – Indian standard railway broad gauge train loadings – permissible stresses. Detailing; General layout of Plate Girder and Truss girder bridges.

Bearings: Types and general description of various bearings, Design of Rocker and roller bearings for railway bridges.

UNIT- IV:

Design of Deck type riveted plate girder railway bridges: Economical depth, detailed design of Cross section, connections, intermediate and bearing stiffeners, Wind effects-Design of Cross frames.

UNIT- V:

Design of Through type riveted truss girder railway bridges: Truss configurations, Design of stringer beams, Cross girders; Wind effects- Design of top lateral and bottom Lateral bracing, Portal and sway bracings, Estimation of Design Forces for the main members of the Truss girder.

Text Books:

1. S. K. Duggal, "Limit State Design of Steel Structures", 3rd Edition, Mc Graw HillHED, 2019.
2. N. Subramanian "Design of Steel Structures: Limit state method" 3rd Edition, Oxford University Press, 2018.

Suggested Reading:

1. A.S. Arya and J.L Ajmani "Design of Steel Structures", Nem Chand & Bros. 2014.
2. M.R. Shiyekar, "Design of Steel Structures, (Limit State Method", Second Edition, PHI Learning Pvt Ltd. 2013
3. Ramachandra and Virendra Gehlot, "Design of Steel Structures", Volume – 2, Scientific Publishers, 2008.

E Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105162/
2. https://archive.nptel.ac.in/courses/105/106/105106112/

22CE E20

RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEM

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: To enable the students

1. To identify the problems pertaining to rural water supply and sanitation.
2. To understand water treatment systems for rural community.
3. To understand wastewater treatment and sanitation systems in rural areas.
4. To apply on-site sanitation system for Industrial Hygiene and Sanitation.
5. To design low-cost waste management systems for rural areas, plan and design an effluent disposal mechanism.

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

1. Identify the problems related to rural water supply and sanitation.
2. Apply different stages of water treatment and sanitation system for rural community.
3. Plan wastewater collection system in rural areas and identify compact wastewater treatment units.
4. Develop occupation related onsite sanitation, hygiene system and identify occupational hazards.
5. Design an effluent disposal mechanism and develop solid waste management system in rural areas.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	1	1	-	-	-	1	2	1	2
CO2	2	1	-	-	-	1	1	1	-	-	-	1	2	2	2
CO3	2	1	-	-	-	1	1	1	-	-	-	-	2	1	2
CO4	2	-	-	-	-	1	1	1	-	-	-	1	2	1	2
CO5	3	2	2	-	-	2	1	1	-	-	-	2	2	2	2

UNIT- I:

Rural Water Supply: Issues of rural water supply, various techniques for rural water supply- merits, National rural drinking water program, rural water quality monitoring and surveillance, operation and maintenance of rural water supplies, Relationships between diseases and water quality, hygiene and sanitation.

UNIT- II:

Water Treatment: Need for water treatment, point of use water treatment systems, filters, bio-sand filters, disinfection systems for rural areas, chlorination, solar disinfection systems, removal of arsenic, fluoride and iron. Hygiene and sanitation, Low cost treatment: Epidemiological aspects of water quality methods for low cost water treatment - Specific contaminant removal systems

UNIT- III:

Rural Sanitation: Introduction to rural sanitation, community and sanitary latrines, planning of wastewater collection system in rural areas, Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas.

UNIT- IV:

Onsite sanitation system: Nexus between water quality and sanitation. Importance of hydrogeology on selection of onsite sanitation systems, Industrial Hygiene and Sanitation: Occupational Hazards- Schools- Public Buildings-Hospitals, Industrial plant sanitation.

UNIT- V:

Septic tanks: Design of septic tanks, single pit and double pit toilets. Small bore systems, bio digesters, constructed wetlands, sludge/seepage management systems, solid waste management: Biogas plants - Rural

health - Other specific issues and problems encountered in rural sanitation.

Text Books:

1. Gupta, S. “Rural Water Supply and Sanitation”, Vayu Education of India, New Delhi, 2014, 1st Edition.
2. Ahluwalia, P. and Nema, A. K., “Water and Wastewater Systems: Source, Treatment, Conveyance and Disposal”, S. K. Kataria & Sons, 2012, Reprint edition.

Suggested Reading:

1. Christine Sijbesma and Meine Pieter van Dijk, “Water and Sanitation-Institutional Challenges in India”, Manohar Publishers and Distributors, India, June 2006
2. A handbook on “Technological Options for On-site sanitation in rural areas”, Ministry of Drinking water & Sanitation, Govt. of India, New Delhi, June 2016.
3. Guidelines “Research & Development for Rural Water Supply & Sanitation Sector”, Ministry of Rural Development, Govt. of India, New Delhi, 2003.

E Resources:

1. https://archive.nptel.ac.in/courses/105/101/105101215/
2. https://onlinecourses.nptel.ac.in/noc22_ce45/preview
3. https://nptel.ac.in/courses/105104102
4. https://www.expertnotes.in/courses/water-supply-or-rural-water-supply-and-onsite-sanitation-system/

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

In line with AICTE Model Curriculum with effect from AY 2023-24

BE (Civil Engineering)

SEMESTER – VIII:

Sl No	Course code	Title of the Course	Scheme of instruction Hours per week			Scheme of Examination			Credits
			L	T	P	Duration of SEE in hours	Max marks CIE	Max marks SEE	
1	-	PE-6	3	-	-	3	40	60	3
2	22CE C34	Technical Seminar	-	-	2	-	50	-	1
3	22CE C35	Project Part-II	-	-	8	-	100	100	4
4	22CE C36	Practical Skills in Civil Engineering	-	3	-	3	50	50	1.5
		Total	**3**	**3**	**10**		**240**	**210**	**9.5**
Clock Hours per week: 16									

Professional Electives - 6

22CE E21	Pavement management system
22CE E22	Introduction to Tall Buildings
22CE E23	Water shed management
22CE E24	Ground Improvement Techniques

22CE C34

TECHNICAL SEMINAR

Instruction	2P Hours per week
Duration of Semester End Examination	Hours
Semester End Examination	Marks
Continuous Internal Evaluation	50 Marks
Credits	1

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state-of-the-art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

Course Objectives: To enable the students to

1. Analysis and comprehension of proof-of-concept and related data.
2. Establish motivation for any topic of interest and develop a thought process for technical presentation.
3. Organize a detailed literature survey and build a document with respect to technical publications.
4. Make use of new and recent technology for creating technical reports
5. Effective presentation and improve soft skills.

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

1. Identify their domain interest through critical review of literature.
2. Develop the technical skill in preparing a well-structured report on the chosen topic of CivilEngineering by following ethical practices.
3. Develop the skill of presenting a structured seminar using Power Point presentation tools.
4. Improve communication skills.
5. Defend one's presentation by healthy interactions with the participants.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	-	-	3	2	-	-	-	3	-
CO2	2	3	-	-	-	-	-	-	3	2	-	-	-	3	-
CO3	2	3	-	-	1	-	-	-	3	2	-	1	-	3	-
CO4	2	3	-	-	-	-	-	-	3	3	-	-	-	3	-
CO5	2	3	-	-	-	-	-	-	3	2	-	-	-	3	-

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References Each student is required to:
6. Submit a one-page synopsis of the seminar talk for display on the notice board.
7. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
8. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shallbe discouraged.

For the award of sessional marks, students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications

Guidelines for awarding marks		
Sl No.	Description	Maximum Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

22CE C35

PROJECT PART 2

Instruction	12P Hours per week
Duration of Semester End Examination	Hours
Semester End Examination	100 Marks
Continuous Internal Evaluation	100 Marks
Credits	4

Course Objectives: To enable the students to

1. Survey and study of published literature on the assigned topic
2. Working out a preliminary Approach to the Problem relating to the assigned topic
3. Conducting preliminary Analysis/Modeling/Simulation/Experiment/ Design/Feasibility
4. Preparing a Written Report on the Study conducted for Presentation to the Department
5. Final Seminar, as oral Presentation before a departmental Committee

Course Outcomes:

At the end of the course, the students will be able to

1. Examine the chosen problem with a deeper insight and identify a path to problem solving while developing the skill of coordinating with the team.
2. Develop and demonstrate problem solving skills through detailed Analysis/ Modeling/ Simulation/ Experimental works.
3. Evaluate the results based on deeper studies and draw conclusions along with scope for further studiesto facilitate continuous learning.
4. Develop the art of technical report writing by following ethical practices.
5. Defend the work through a well-structured presentation.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO2	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO3	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO4	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1
CO5	2	2	3	2	1	-	-	-	3	2	-	-	2	3	1

The object of 'Project Part 2' is to enable the student extend further the investigative study taken up either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a supervisor from the department alone or jointly with a supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the students in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned.
2. Review and finalization of the approach to the problem relating to the assigned topic.
3. Preparing an action plan for conducting the investigation, including team work.
4. Detailed analysis/ Modelling/ Simulation/ Design/ Problem Solving/ Experiment as needed.
5. Final development of product/ process, testing, results, conclusions and future directions.
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible.
7. Preparing a dissertation in the standard format for being evaluated by the department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in Continuous Internal Evaluation: (Max Marks: 100)

	Maximum Marks	Evaluation Criteria / Parameter
Evaluation by	10	Review – 1
	15	Review – 2
	25	Submission
	10	Regularity and Punctuality
	10	Work Progress

	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	Analytical / Programming / Experiment Skills

Guidelines for the award of marks in Semester End Examination: (Max Marks: 100)

Evaluation by	Maximum Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the Project Innovations Applications Live Research Projects Scope for future study Application to society
	20	Viva-Voce

22CE C36

PRACTICAL SKILLS IN CIVIL ENGINEERING

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: To enables the students to

1. Develop Topo sheets for a given area and mark the columns and footings for a building using surveying principles record M book entries.
2. Read and interpret the drawings of RC / Steel structures including structural details.
3. Estimate the steel quantity required for various structural elements of an RC building.
4. Conduct field tests on building materials and NDT
5. Prepare a report of observations on destressed / industrial structures.

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

1. Develop toposheets for the given area.
2. Understand and interpret R.C and Steel structural drawings.
3. Estimate the steel quantities for various RC structural components.
4. Mark the positions of footings and columns as per the drawings and record M book entries.
5. Demonstrate Field tests on building materials and NDT.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	3	-	-	-	-	3	2	-	-	2	3	3
CO2	2	1	-	3	-	-	-	-	3	2	-	-	2	3	3
CO3	2	3	-	3	-	-	-	-	3	2	-	-	2	3	3
CO4	2	-	-	3	-	-	-	-	3	2	-	-	2	3	3
CO5	2	2	-	3	2	-	-	-	3	2	-	2	2	3	3

List of Experiments:

1) Preparation of Topo sheets.
2) Interpretation of structural drawings of RC Buildings.
3) Estimation of steel for
    a) RC Footings
    b) RC Columns
    c) RC Slabs and
    d) RC beams.
4) Marking of columns and footings on site.
5) Field tests on building materials.
6) Measurement (M) book entries.
7) Non-Destructive Testing.
8) Interpretation of structural drawings of Steel Structures.
9) Visit to distressed structures (NDT).
10) Visit to Industrial structures/Pre-cast unit.

Text Books:

1. Practical Civil Engineering by P.K. Jaya Sree, K Balan and V Rani, CRC Press (Taylor & Francis Group) 2021.

Suggested Reading:

Practical Civil Engineering, Hand Book by Rahul Nitin Gupta,

E Resources:https://archive.nptel.ac.in/courses/105/106/105106201/

22CE E21

PAVEMENT MANAGEMENT SYSTEM

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: To enable the students to

1. Develop a comprehensive understanding of the various types of data required for the development of project management systems in pavement engineering.
2. Acquire the ability to differentiate and diagnose different types of pavement distresses, identifying their root causes, and proposing appropriate remedial measures.
3. Gain proficiency in interpreting field evaluation data and pavement design data in the context of both present and future traffic conditions.
4. Develop analytical skills for pavement design based on structural response models, enabling the selection of optimal design solutions through economic evaluation techniques.
5. Learn to optimize maintenance strategies by evaluating the benefit-to-cost ratio of various project alternatives**.**

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

1) Explain the key considerations in applying the concept of total pavement management system.
2) Illustrate the applications of pavement performance and evaluating pavement condition.
3) Choose optimum pavement design strategy and perform economic evaluations.
4) Evaluate basic approaches to establish rehabilitation and maintenance strategies
5) Apply pavement costs and benefit factors for economic evaluation.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	3	-	-	-	-	2	-	-	-	-	-	2	-	3
CO3	2	3	-	-	-	-	2	-	-	-	3	-	2	-	3
CO4	2	3	-	-	-	-	2	-	-	-	3	-	2	-	3
CO5	2	3	-	-	-	-	2	-	-	-	3	-	2	-	3

UNIT I:

Introduction to Pavement Management: Role of pavements in today's transport system, types of pavements, concepts of pavement management and essential features of pavement management.

Pavement Management Levels and Functions: The ideal Pavement Management System (PMS), the network and project levels of pavement management, influence levels of PMS components, pavement management at three levels, PMS function, key consideration in application of a total pavement management system concept, the function of pavement evaluation.

UNIT II:

Pavement Performance: The serviceability-performance concept, characterization of pavement roughness, equipment for evaluating roughness, a universal roughness to standard, relating roughness to serviceability, applications of roughness data.

Evaluation of Pavement Structural Capacity: Basic considerations, non-destructive measurement and analysis, deflection devices, destructive structural evaluation, structural capacity index concepts, network versus project level applications of structural capacity evaluation.

Evaluation of Pavement Distress: Condition Surveys, Principles of surface distress surveys, survey methodology, types of distress, examples of distress survey procedures, equipment for distress evaluation, pavement distress indexes, applications of distress data.

UNIT III:

Design Alternatives, Rehabilitation and Maintenance: Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, life cycle costing, analysis of alternate pavement strategies based on distress and performance, case studies, equipment's, Identification of Alternatives-Deterioration Modeling.

UNIT IV:

Priority Programming of Rehabilitation and Maintenance: Basic approaches to establishing alternatives and policies, selecting a length of program period, basic functions of priority programming, priority programming methods, mathematical programming (optimization method), examples and comparisons, budget level evaluation, funding level requirements for specified standards, final program selection.

UNIT V:

Economic Evaluation of Alternative Pavement Design Strategies: Introduction, basic principles, pavement costs and benefit factors, methods of economic evaluation, economic analysis example, limitations of economic analysis.

Selection of an Optimal Design Strategy: Role of the decision maker, basic for optimal strategy selection, communicating results.

Text books:

1. Ralph Haas, W. Ronald Hudson, and Lynne Cowe Falls, "Pavement Asset Management", Wiley-Scrivener, 2015.
2. R Srinivasa Kumar "Pavement Evaluation & Maintenance Management System", Universities Press (India) Private Ltd., 2014.

Suggested Reading:

1. R Srinivasa Kumar "Pavement Evaluation & Maintenance Management System", Universities Press (India) Private Ltd., 2014.
2. Haas R. C. G., W. Ronald Hudson, John P. Zaniewski, "Modern Pavement Management", Krieger Publishing Company, 1994.
   M. Rashad Islam "Pavement Design: Materials, Analysis, and Highways, 1st Edition", McGraw Hill Publication, 2020.

E Resources:

1. https://nptel.ac.in/courses/105104098
2. https://onlinecourses.nptel.ac.in/noc23_ce49

22CE E22

INTRODUCTION TO TALL BUILDINGS

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: To enable the students to

1. To study the behaviour of tall structures.
2. To learn analysis and design of buildings for wind loads
3. To study design criteria for tall structures.
4. To familiarize the students about stability analysis of tall structures.
5. To study behaviour of various structural systems under wind loads.

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

1. To understand behaviour of various structural systems under different loading
2. conditions.
3. Identify the criteria for design of various structural systems.
4. Implement the latest construction practices and processes for various structural systems.
5. Analyse wind and seismic effects on tall buildings.
6. Analyze and design high rise structures using structural engineering software

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	3
CO2	2	2	-	-	-	-	-	-	-	-	-	1	2	-	3
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	-	3
CO4	2	2	3	-	-	-	-	3	-	-	-	1	2	-	3

UNIT - I

Evolution of Tall buildings: Introduction - Design criteria for structural design of Tall building - Concept of premium for height - Development of high rise architecture. Assembly of Building and site investigation: Building performance –cost, quality and time

UNIT - II

Environmental requirements: Industrialization& Robotics in Construction - Introduction to safety and Health Management System - Stages of site Investigation - Site Reconnaissance & Ground investigation-Field tests & Laboratory tests. Foundation systems

UNIT - III

Material handling and Mechanization: Material handling considerations - Earthmoving equipment's - Horizontal and vertical movements - Selection & Utility of Cranes (Tower Cranes & Climbing Cranes). Wind & seismic effects on behavior of Tall Structures: Outlook of Design considerations and Characteristics of wind - Codal wind loads and cladding pressures on behavior of tall buildings - Introduction to Tall building behavior during earthquakes and seismic design philosophy.

UNIT - IV

Structural Forms & Flooring Systems: Introduction of Various structural forms and their importance to high rise architecture - Introduction to various Flooring Systems in concrete & steel.

UNIT - V

Modelling for analysis: Approaches for analysis - Assumptions involved in modeling - Reduction techniques - Application using Structural engineering Software.

Text Books:

1. Design and analysis of Tall and Complex Structures, Feng Fu, Butterwoth Heinemann, 2018.
2. Tall Building Design: Steel, concrete and composite system, Taranath B, CRC Press, 2016, 1st Edition.

Reference Books:

1. Tall Building Structures: Analysis and Design, Bryan Stafford Smith and Alex Coull, Wiley, 1991, 1st Edition.
2. Planning for Tall Buildings, Michael J Short, Routledge, 2012.
3. Construction Technology for Tall Buildings, Yit Lin Michael Chew, World Scientific Publication, 2017.

E Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ar02/preview
2. https://www.byggmek.lth.se/fileadmin/byggnadsmekanik/publications/tvsm5000/web5213.pdf

22CE E23

WATERSHED MANAGEMENT

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: To enable the students to

1. Understand the concepts of watershed management and socio-economic aspects.
2. Understand Characteristics of Watershed, soil erosion and its control.
3. Familiarize with various water harvesting methods and land use management practices.
4. Understand Social Aspects of Watershed Management.
5. Understand the concept of integrated watershed and ecosystem management.

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

1. Analyze watershed characteristics to take appropriate management action.
2. Identify areas and estimate soil erosion
3. Design rain water harvesting structures
4. Plan watershed management with community participation
5. Apply Principle of integrated Watershed Management and manage Ecosystem.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	1	-	-	-	-	-	-	-	-
CO2	3	1	1	-	-		1	-	-	-	-		1	-	1
CO3	3	1	1	-	-	1	1	-	-	-	-	1	1	-	1
CO4	3	1	-	-	-	1	1	-	-	1	-	1	-	-	1
CO5	3	1	-	-	-	-	1	-	-	-	1	1	-	-	1

UNIT – I:

Definition and concept of Watershed: Concept of watershed development, History of Watershed management and its relevance to India, objectives of watershed development, different stake holders & their relative importance, need for watershed development in India, selection of watershed, watershed policy issues, Integrated and multidisciplinary approach for watershed management.

UNIT – II:

Characteristics of Watershed: Size, shape, physiographic, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socioeconomic characteristics, Morphometric parameters-linear, areal and relief aspects, Prioritization of watersheds.

Principles of Erosion: Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion.

Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rock fill dams, brushwood dam, Gabion, Hedge barrier, Mixed cropping, Strip cropping, Mulching.

UNIT – III:

Water Harvesting: Rainwater harvesting, catchment harvesting, harvesting structures and Design of harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds and percolation tanks. Roof top water harvesting

Land Management: Land use and land capability classification, management of forest, agricultural, grassland and wild land, reclamation of saline and alkaline soils.

UNIT – IV:

Social Aspects of Watershed Management: Planning of Water shed management activities, community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water

legislation and implementations, Case studies.

UNIT – V:
Integrated Watershed Management: Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources.

Ecosystem Management: Role of Ecosystem, crop husbandry, soil enrichment, inter mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, horticulture, social forestry and a forestation.

Text Books:

1. Murthy, J.V.S., "*Watershed Management*", New Age International (P), Ltd., New Delhi,2017.
2. Majumdar, D.K., "*Irrigation and Water Management*", Prentice Hall, New Delhi, 2014.

Suggested Reading:

1. Mohan Das, M. and Das Saikia, "*Watershed Management*." PHI Learning (P)., Ltd., New Delhi, 2013.
2. Goswami, M.D., "*Water shed Management: Theory and Practices*." Ritwik and Gargee (P)., Guwahati, Assam, 2004.
3. Srinivasa Raju K. and Nagesh Kumar D, "*Multicriterion Analysis in Engineering and Management*", Prentice Hall of India (PHI) Learning Pvt. Ltd, New Delhi, 2014.

E Resources:

1. https://nptel.ac.in/courses/105101010
2. https://onlinecourses.swayam2.ac.in/cec21_ge14/preview

22CE E24

GROUND IMPROVEMENT TECHNIQUES

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 Objective: To enable the students

1. To impart fundamental knowledge of Ground Improvement Techniques.
2. To make capable of differentiating between different types of ground improvement techniques.
3. To make capable of choosing the appropriate method of Ground Improvement according to site conditions and requirement of the project.
4. To make capable of designing the appropriate method of Ground Improvement according to site conditions and requirement of the project
5. To impart fundamental knowledge about advanced stabilizing techniques and sustainable materials for slopes and ground improvement.

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

1. Explain the importance of ground improvement techniques and identify best suited technique for different soils.
2. Apply suitable chemical stabilization or grouting techniques based on ground condition to address the field problems.
3. Identify and design various ground improvement techniques suitable for the cohesion less soil.
4. Select suitable ground improvement techniques for cohesive soils based on project requirement.
5. Interpret advanced stabilizing techniques and sustainable materials for slopes and ground improvement.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3
CO2	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3
CO3	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3
CO4	2	3	-	-	-	1	-	-	-	-	-	-	2	-	3
CO5	2	3	-	-	-	1	2	-	-	-	-	-	2	-	3

UNIT- I:

Introduction: Need for ground improvement, applications, and factors affecting – different mechanical, chemical, static and dynamic techniques – mechanical stabilization – blending of aggregate – Rothfutch Testing. Concept of Soil confinement, Gabion Walls, Crib Walls and Sand Bags.

UNIT – II:

Chemical stabilization: Lime, Cement, Bitumen, Emulsions, Chemicals, factors influencing–Design approach, construction procedure, laboratory testing, additives. Suspension and solution grouts, Principles, method, equipment, applications, compaction grouting, jet grouting, field compaction control.

UNIT – III:

Improvement of Cohesion less soils: In Situ densification, Vibro techniques– Mechanisms. Factors affecting, suitability number, compacting piles. Vibro replacement process, Vibro flotation process, Terra Probe Method, Dynamic Compaction.

UNIT- IV:

Improvement of Cohesive soils: In Situ densification, Pre-loading–Dewatering– sand drains. Sand wicks, geo-drains, rope-drains, band-drains, stone columns, and lime piles, thermal and vacuum methods.

UNIT – V:

Ground treatment for Slopes: Different types of in-situ soil stabilization like soil nailing, anchoring, pre-stressed anchoring - construction techniques.

Geosynthetic: Woven and non-woven fabrics. Types, functions and applications– Geo-textiles, geo-grids, tests on geo-textiles, Reinforced earth – Principles and factors governing design.

Text Books:

1) P. Purushothama Raj, "Ground Improvement Techniques", Laxmi publications 2016.
2) K.R Arora, "Soil Mechanics and Foundation Engineering", 7th Edition, Standard Publishers, 2008

Suggested Reading:

1. R. Hausmann., "Engineering Principles of Ground Modification", McGraw Hill Publishing Co.,2013.
2. G. V. Rao and G. V. S. S. Raju, "Engineering with Geosynthetics", McGraw Hill Education, 2012
3. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas publishing house Pvt. Ltd, 2012.
4. IRC-SP 58 (2001): "Guidelines for use of fly ash in road embankments".

E Resources:

1. https://nptel.ac.in/courses/105108075
2. https://archive.nptel.ac.in/courses/105/105/105105210/

OPEN ELECTIVES

(Offered by Civil Engg. Department to other Departments)

Sl. No.	Code	Subject Name	Semester
1	22CE O01	Infrastructure for Smart Cities	Even semester
2	22CE O02	Disaster Risk Reduction and Management	Odd semester
3	22CE O03	Green Buildings for Sustainable Infrastructure	Odd semester
4	22CE O04	Project Planning and Management	Even semester
5	22CE O05	Intelligent Transportation Systems	Odd semester
6	22CE O06	Environmental Pollution Management	Even semester

22CE O 01

INFRASTRUCTURE FOR SMART CITIES

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: To enable the students to

1. Comprehend the Necessity of Infrastructural Development for Smart Cities.
2. Illustrate the Components and Planning Aspects of a Smart City.
3. Outline Smart Transportation Systems for Smart Cities.
4. Summarize the Significance of Disaster Resilient Infrastructure in Smart Cities.
5. Review Policies and Implementation of Smart Cities at National and Global Perspectives.

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

1. Understand the necessity of infrastructural development for smart cities.
2. Illustrate the components and planning aspects of a smart city.
3. Outline smart transportation systems for smart cities.
4. Summarize the significance of disaster resilient infrastructure in smart cities.
5. Review policies and implementation of smart cities at national and global perspective.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	-	-	-	-	-	-	2	-	3
CO2	2	-	-	-	-	1	-	-	-	-	-	-	2	-	3
CO3	2	-	-	-	3	1	-	-	-	-	-	-	2	-	3
CO4	2	3	-	-	3	1	-	-	-	-	-	-	2	-	3
CO5	2	-	-	-	-	1	-	-	-	-	3	-	2	-	3

UNIT I

Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment

UNIT II

Planning and development of Smart city Infrastructure: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security.

UNIT III

Intelligent transport systems: Connected vehicles, autonomous vehicles, GPS, Navigation system, traffic safety management, mobility services, E-ticketing.

UNIT IV

Disaster resilient Infrastructure: Electricity, sanitation and water supply systems, fire hazard management, earthquake resilient structures, ICT tools.

UNIT V

Infrastructure Management: System and Policy for Smart city, integrated infrastructure management systems, worldwide policies for smart city, Government of India - policy for smart city, Smart cities in India, Case studies of smart cities.

Text Books:

1. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany (ISBN: 0-87395-678-8)
2. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science

References:

1. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science.
2. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf
3. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988 5. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997.

E Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ar12/preview
2. http://acl.digimat.in/nptel/courses/video/105105160/L01.html

22CE O02

DISASTER RISK REDUCTION AND MANAGEMENT

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: To enable the students to

1. To learn about the types, causes, impacts and management concept of disaster.
2. To learn about the disaster management cycle and early warning systems
3. To make the students become aware of stress and trauma management during a disastér.
4. To identify the role of technology and institutional framework behind disaster management in India.
5. To identify the structural and non-structural measures of disaster mitigation and learn about the provisions of Disaster management Act.

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

1. Explain the fundamental concepts of disaster management.
2. Demonstrate the principles and practices of disaster risk reduction management.
3. Identify stress and its management during disaster.
4. Outline institutional frame work at different levels of administration.
5. Evaluate disaster management study including data search, analysis and presentation as a case study.

CO-PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	2	3	-	-	-	-	1	-	-	-
CO2	2	-	-	-	-	2	3	-	-	-	-	1	-	-	-
CO3	2	-	-	-	-	2	3	-	-	-	-	1	-	-	-
CO4	2	-	-	-	2	2	3	-	-	-	-	1	-	-	-
CO5	2	-	-	-	-	2	3	-	-	-	-	1	-	-	-

UNIT I

Fundamental concepts in disaster management: Hazard and disaster-concepts, vulnerability and risk, Hazard and disaster type – Natural, Water- related, pandemic and Human induced hazards disasters. Causes and Impacts of disasters – Impacts on natural eco systems: physical, psychological and social impact. Disaster and financial resilience. Disaster vulnerability profile of India –Specific to geographical regions and states (as per regional significance)

UNIT II

Disaster Management Cycle: Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness. Disaster risk reduction (DRR). Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards and Early warning systems

UNIT III

Disaster Impacts Management: Trauma and stress management, First aid and emergency procedures Awareness generation strategies for the community on safe practices in disaster (as per regional significance)

UNIT IV

Institutional framework of disaster management in India: NDMA-SDMA, NDRF, civic volunteers, and NIDM. Phases of disaster/risk management and post-disaster responses. Compensation and insurance Applications of remote sensing & GIS in disaster management. Components of disaster management. Preparedness of rescue and relief, mitigation, rehabilitation & reconstruction. Institutional frame work of disaster management in India

UNIT V

Capacity building for disaster/damage mitigation: Structural and Nonstructural measures forcapacity building for disaster/damage mitigation. Disaster risk reduction strategies and national disaster management guidelines. Disaster management Act -2005. Regional issues as per regional requirement/university can take minimum two topics as per high powered committee

Text Books:

1. Singh, R. (2017), "Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami". Horizon Press publications.
2. Taimpo (2016), "Disaster management and preparedness". CRC Press Publications

Suggested Reading:

1. Nidhi, G.D. (2014), "Disaster management preparedness" .CBS Publications Pvt. Ltd.
2. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S. (2013), "Flood Disaster Risk Management-CBS Publications Pvt Ltd.
3. Singh, R. (2016), "Disaster management Guidelines for Natural Disasters" Oxford University PressPvt. Ltd

E Resources:

1. https://nptel.ac.in/courses/124107010
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

22CE O03

GREEN BUILDINGS FOR SUSTAINABILE INFRASTRUCTURE

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: To enable the students

1. To understand the concepts of green buildings.
2. To remember the quality and uses of green building materials.
3. To acquire the concepts of design and construction of green buildings.
4. To remember and understand the policies and rating systems of green building.

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

1. Identify green building and green building materials.
2. Make use of different rating agencies to classify the type of building.
3. Analyze sustainability and its implications for the practice of engineering.
4. Evaluate the potential of the alternative construction materials for sustainability.
5. Examine the green building rating systems and its contribution to sustainability.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	1	1	3	-	-	-	-	-	2	-	3
CO2	2	-	-	-	-	1	3	-	-	-	-	-	2	-	3
CO3	2	-	-	-	1	1	3	-	-	-	-	-	2	-	3
CO4	2	-	-	-	-	1	3	-	-	-	-	-	2	-	3
CO5	2	-	-	-	1	1	3	-	-	-	-	-	2	-	3

UNIT-I

Course Syllabus Green Building: Concept of Green building, Principles of green buildings, Eco-friendly materials, Certification systems – Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED).

UNIT-II

Green Building Materials: Green Building Materials and Equipment in India, what are key requisites for Constructing a Green Building, Important Sustainable features for Green Building.

UNIT-III

Building Services: Fire protection – classes of fire and causes, development of fire, fire resisting materials, means of escape, Standing Fire Advisory Council norms. Water supply -Water distribution and plumbing fixtures.

Applications in the Built Environment: Concepts of green buildings, climate responsive building - Reduction of energy consumption, direct and indirect methods - Reduction of water consumption, direct and indirect methods - Carbon footprint and eco footprints of buildings - New concepts and trends in green buildings, national and international.

UNIT-IV

Sustainability: The Concept of Sustainability; Definition of Sustainability, Dimension of Sustainability. Three Pillars of Sustainability, Principles of Sustainability - 5R, Construction Materials Resource Efficiency, Operational Reuses of the Construction Materials, Sustainability Goals for construction Industry.

UNIT-V

Sustainability in Built Environment: Environmentally sensitive design, low impact development, green

infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings.

Books and Materials Text Books:

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5th edition, 1994.
2. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7th edition, 2013.

Reference Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Bradley A. Striebig, Adebayo A. Ogundipe and Maria Papadakis, Engineering Applications in Sustainable Design and Development, 1st edition, 2016.
3. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.

E Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102195/
2. https://archive.nptel.ac.in/courses/124/107/124107011/

22CE O04

PROJECT PLANNING AND MANAGEMENT

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: To enable the students to

1. The discipline of project and programme management, within an overall appreciation of the nature and purpose of projects.
2. The principles and practice of project planning, design, preparation, and appraisal techniques for projects in a development context.
3. The theory and practice of management skills for project and programme management, focusing particularly on 'hard' and 'soft' skills for successful project implementation.

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

1. After the completion of the course, the student will be able to:
2. Identify project characteristics and various phases of a project.
3. Illustrate project organization, staffing and feasibility of projects.
4. Apply the techniques of Project planning, scheduling and Execution Control.
5. Evaluate Resources, Budget, Claims and Disputes.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-		-	2	-	-	3	-	2		3
CO2	2	3	-	-	-		-	-	-	-	3	-	2		3
CO3	2	3	-	-	-		-	-	-	-	3	-	2		3
CO4	2	2	-	-	-	3	-	-	-	-	3	2	2		3
CO5	2	2	-	-	-	3	-	2	-	-	3	2	2		3

UNIT-I

Project Management: Overview of Project Management, Concepts and Definitions. Project manager and his responsibilities. Types of projects, various stages of projects, Organizational structures used in project management. Management Functions and staffing.

UNIT-II

Project Planning: Time planning, Contents of Project plan, planning process, Work breakdown structure, process mapping. Project Budgeting: Financial Projections, time value of money, cost of capital, capital investment decisions.

UNIT-III

Scheduling Techniques: Bar Charts, CPM & PERT: Time estimate- Optimistic time estimate, Most likely time estimate, Pessimistic time estimate & Expected time. Project Scheduling, Network Analysis, Cost- Time Analysis in Network Planning, Float - Total float, free float.

UNIT-IV

Monitoring and Controlling: Plan monitor control cycle, data collection and reporting, Project control. Working with stakeholders.

UNIT-V

Conflict Management: claims and Disputes- Source of claim, Claim Management, Dispute resolution, Arbitration and its advantages, Project closure.

Text Books:

1. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.
2. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Reference Books:

1. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
2. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006.
3. Angerame, Mike. Engineering & construction project management. Denver, Colo: Hampton Group, 2002.

E-Resources:

1. https://archive.nptel.ac.in/courses/105/104/105104161/
2. https://archive.nptel.ac.in/courses/110/104/110104073/

22CE O05

INTELLIGENT TRANSPORTATION SYSTEMS

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: To enable the students to

1. To understand the fundamentals of ITS.
2. To understand the role and application of data collection techniques in modern transportation systems.
3. To Understand the processes involved in information management and the operation of Traffic Management Centres (TMC).
4. Gain detailed knowledge of various functional areas within ITS.
5. Evaluate the implementation and impact of ITS programs in both developed and developing countries, recognizing global trends and challenges.

Course Outcomes: After successfully completing the course, the students will be able to

1. Outline the fundamental components of ITS.
2. Demonstrate the ability to identify various data collection techniques used in ITS.
3. Understand the telecommunications and information management in ITS.
4. Gain in-depth knowledge of the functional areas within ITS.
5. Evaluate the different user needs and services provided by ITS.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	3	-	-	-	-	-	2	-	3
CO2	2	2	-	-	-	1	3	-	-	-	-	-	2	-	3
CO3	2	2	-	-	-	1	3	-	-	-	-	-	2	-	3
CO4	2	2	-	-	-	1	3	-	-	-	-	-	2	-	3
CO5	2	-	-	-	-	1	3	-	-	-	-	-	2	-	3

UNIT I

Introduction to ITS: Definition of ITS and identification of ITS objectives, objectives and goals of ITS, historical background, evolution and development of ITS, benefits of ITS, economic, environmental, and social benefits.

UNIT II

ITS Data Collection Techniques: Detectors, types of detectors and their applications; Automatic Vehicle Location (AVL), technology and usage; Automatic Vehicle Identification (AVI), systems and implementation; Geographic Information Systems (GIS), role in ITS; video data collection, techniques and importance.

UNIT III

Telecommunications in ITS: Importance of telecommunications in the ITS system, role and necessity of telecommunications, information management, data collection, storage, and dissemination; Traffic Management Centres (TMC), functions and operations; vehicle – roadside communication, methods and technologies; vehicle positioning system, GPS and other positioning technologies.

UNIT IV

ITS Functional Areas: Advanced Traffic Management Systems (ATMS) concepts and components; Advanced Traveler Information Systems (ATIS), features and benefits; Commercial Vehicle Operations (CVO) systems and management; Advanced Vehicle Control Systems (AVCS), safety and control mechanisms; Advanced Public Transportation Systems (APTS), enhancing public transport efficiency; Advanced Rural Transportation Systems (ARTS), ITS applications in rural areas.

UNIT V

ITS Applications and Global Perspective: ITS user needs and services, travel and traffic management, public transportation management, electronic payment systems, commercial vehicle operations, emergency management, advanced vehicle safety systems, information management, automated highway systems, concepts of vehicles in platoons, integration of automated highway systems, ITS programs in the world, overview of ITS implementations in developed countries, ITS in developing countries.

Textbooks:

1. Ghosh, S., Lee, T.S. Intelligent Transportation Systems: New Principles and Architectures, CRC Press, 2000.
2. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2003.

Reference Books:

1. Karl B. Schnelle, Jr. and Charles A. Brown, Air Pollution Control Technology Handbook, CRC Press, 1st Edition, 2001.
2. Air Pollution by Jeremy Colls, SPON Press, 2nd Edition, 2003.
3. Seinfeld, J.H., Pandis, S.N., Atmospheric Chemistry and Physics, John Wiley, 2006.

E Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ce14/preview
2. https://www.nptelvideos.com/video.php?id=1944&c=11

22CE O06

ENVIRONMENTAL POLLUTION MANAGEMENT

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: To enable students to

1. Knowledge of natural systems which make life possible on Earth.
2. An awareness of the need to manage natural system.
3. An understanding of sustainable development to meet the needs of the present, without compromising the ability of future generations to meet their own need.
4. A sense of responsibility and concern for the welfare of the environment and all organism.
5. A sound basis for further study, personal development and participation in local and global environmental concerns.

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

1. Identify water pollution sources, types and treatment methods.
2. Apply knowledge on Prevention and control of air pollution.
3. Inspect sources, effects and mitigation methods of noise pollution.
4. Examine soil pollution sources, effects and control measures.
5. Develop Environmental management plan to minimize environmental pollution.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	1	3	-	-	-	-	-	2	-	3
CO2	2	2	1	-	-	1	3	-	-	-	-	-	2	-	3
CO3	2	2	1	-	-	1	3	-	-	-	-	-	2	-	3
CO4	2	2	-	-	-	1	3	-	-	-	-	-	2	-	3
CO5	2	-	-	-	-	1	3	-	-	-	-	-	2	-	3

UNIT-I:

Water pollution: Introduction - Sources and types of water pollutants; Physical, Chemical and Biological properties; Ground water - Surface water – seawater, Estuaries. Impacts of water pollution on environment; Water Quality standards (Drinking and Industrial): IS code, CPCB, EPA and WHO - water treatment - physical, chemical and biological. Water Pollution Prevention and Control Act, 1974.

UNIT-II

Air pollution: Structure and composition of atmosphere – classification, sources and effects of air pollution; Environmental issues: Acid rain, global warming and ozone depletion, Air Quality Standards: CPCB, EPA and WHO, Air Quality Index (AQI), Prevention and control of air pollution particulate control – settling chamber, scrubber, bag filter, cyclones electrostatic precipitators. Gaseous emission control methods. Air pollution prevention and control Act 1981.

UNIT-III

Noise Pollution: Noise Pollution Basics of acoustics- propagation of indoor and outdoor sound- noise profiling effects of noise – measurement, index and mitigation methods- health effects of noise. Noise Standards: CPCB and WHO. Noise barrier design.

UNIT-IV

Soil Pollution: Sources, soil mineralogy, organic and inorganic pollutants - types and effects of pollutants on plants, soil pollution control measures - soil microbes and function, bioremediation.

UNIT-V

Environmental management: Environmental impact assessment and statement; Government strategies in pollution control: subsides, polluter pays principle and regulations; Sources of environmental information and regulations; Sustainable development and environmental protection.

Text Books:

1. C. S. Rao, Environmental Pollution Control Engineering, 3rd Edition, New Age International Pvt Ltd, 2018.
2. Rao, M. N and H.V.N. Rao, Air Pollution, Tata McGraw – Hill Publishing Company Limited. New Delhi, 2017.

Reference Books:

1. H.S Peavy, D. R. Rowe, G. Tchobanoglous, Environmental Engineering, Indian Edition, McGraw Hill Education (India) Pvt Ltd, 2014.
2. De Nevers, N., Air Pollution Control Engineering, 3rd edition, Waveland Press Inc 2017.
3. Sagar Pal Singal, Noise Pollution and Control Strategy, 2nd Edition, Alpha Science International Ltd, 2005.

E Resources:

1. https://archive.nptel.ac.in/courses/123/105/123105001/
2. https://archive.nptel.ac.in/courses/103/107/103107215/