22MTC02

CALCULUS
(CIVIL)

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion 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.

CO-PO Articulation Matrix:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

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CHEMISTRY

(CIVIL)

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

COURSE OBJECTIVES: This course aims to

1. This syllabus helps at provluing 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: Completing this course, students will be able to

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

CO-PO Articulation Matrix

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

UNIT-I Atomic and molecular structure and Chemical Kinetics:

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

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

UNIT-II Use of free energy in chemical equilibria

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

Battery technology: Rechargeable batteries & Fuel cells.

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

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

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – conformations 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 – Markonnikoff'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 Alkolinity 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

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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

CO-PO Articulation Matrix:

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

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 de excitation, Superposition, Thevenin's and Norton's Theorems.

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

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22CSC01

PROBLEM SOLVING AND PROGRAMMING

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO Articulation Matrix:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXT BOOKS AND REFERENCES:

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

NPTEL/SWAYAM Course:

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

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CHEMISTRY LAB
(CIVIL)

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

COURSE OBJECTIVES: This course aims to

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

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

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

CO-PO Articulation Matrix

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

List of Experiments:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2} & Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution.
4. Determination of Alkalinity of water.
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassiom 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 NaON solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution with effect from the A.Y. 2022-23
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Asplrin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

TEXT BOOKS

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

SUGGESTED READINGS

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

22MBC02

COMMUNITY ENGAGEMENT

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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

Module I Appreciation of Rural Society

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

Module II Understanding Rural Economy and Livelihood

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

Module III Rural Institutions

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

Module IV Rural Development Programmes

History of Rural Development in India, Current National Programmes: SarvaShikshaAbhiyan, BetiBhachao, BetiPadhao, Ayushman. Bharat, Swachh Bharat, PM AwasYojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

TEXT BOOKS:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

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

22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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

Laboratory / Practical Experiments:

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

Text Books and References:

1. R.S Salaria, "Programming for Problem Solving", Khanna Book Publishing Co., Delhi
2. Jeeva Jose, "Taming Python by Programming", Khanna Book Publishing Co., Delhi

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22MEC37

ROBOTICS AND DRONES LAB
(Common to All Branches)

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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

CO-PO Articulation Matrix:

PO#/ CO#	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO1	3	2	1	1	1	2	1	1	1	2	2	2
CO2	2	3	1	2	3	1	1	1	1	2	2	1
CO3	2	2	2	2	2	1	1	1	1	2	2	2
CO4	2	2	1	2	2	2	1	1	1	2	2	2
CO5	1	1	1	1	1	3	3	3	1	3	3	3

LAB EXPERIMENTS:

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

Suggested readings

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

22EEC02

BASIC ELECTRICAL ENGINEERING LAB

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

COURSE OBJECTIVES: This course aims to

1. To acquire the knowledge on differept 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: Completion this course, students will be able to

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

CO-PO Articulation Matrix:

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

List of Laboratory Experiments/Demonstrations:

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

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

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22PYC05

MECHANICS AND MATERIALS SCIENCE
(Civil & Mechanical)

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

COURSE OBJECTIVES: This course aims to

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: Completion this course, students 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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	1	1	1	1	2	2	1	1	2	1	2
C02	3	1	2	1	2	2	2	1	2	2	2	2
C03	2	2	1	1	1	1	1	1	1	2	1	2
C04	3	2	2	2	2	2	2	1	1	2	1	2
C05	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 ferrimagnetic materials – Wiss 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 diapersion – 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, 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.

22MTC05

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS
(CIVIL)

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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 Nomerical Methods.

CO-PO Articulation Matrix

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V:

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22CEC01

ENGINEERING MECHANICS

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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

CO-PO Articulation Matrix:

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

UNIT – I

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

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

UNIT – II

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

UNIT – III

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

UNIT– IV

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

UNIT – V

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

TEXT BOOKS:

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

SUGGESTED READING:

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

22EGC01

ENGLISH
(Common to All Branches)

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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

CO-PO-PSO Articulation Matrix

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

UNIT-I

Understanding Communication in English:

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

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

UNIT-II

Developing Writing Skills I:

Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

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

UNIT-III

Developing Writing Skills II:

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

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

UNIT-IV

Developing Writing Skills III:

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

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

UNIT-V

Developing Reading Skills:

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

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

TEXT BOOKS:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan,2017.
2. Swan Michael. Practical English Usage.OUP. 1995.

Suggested Readings:

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

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: This course aims to

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 of electrons in electric and magnetic fields

COURSE OUTCOMES: Completion this course, students 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

CO-PO Articulation Matrix

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

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 onapled 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 TWELVE experiments should be done.

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22EGC02

ENGLISH LAB
(Common to All Branches)

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Completion this course, students will be able to

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

CO-PO-PSO Articulation Matrix

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

EXERCISES

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

SUGGESTED READING

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan,2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India,2005.
3. PriyadarshiPatnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd2011
4. AnunaKoneru, Professional Speaking Skills, Oxford University Press,2016

22MEC01

CAD AND DRAFTING

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

COURSE OBJECTIVES: This course aims to

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

Outcomes: At the end of the course, the Students are able to

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

CO-PO-PSO Correlation Matrix

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

List of Exercises:

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

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 R.C., "Engineering Drawing", 2/e, Pearson, 2009. K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.

22MEC38

DIGITAL FABRICATION LAB

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

COURSE OBJECTIVES: This course aims to

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

COURSE OUTCOMES: Cothpletion 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 understaud reverse engineering process.
5. Conceptualize and produce simple device/mechanism of their choice.

CO-PO-PSO Correlation Matrix

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

List of exercises:

Group-1

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dove tail-joint on the given wooden piece according to the given dimensions.
3.
   a. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch
   b. Wiring of two light points connected in series and controlled by single pole switch Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
4. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.
5. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings & bends.
6.
   a. A. To connect the GI pipes as per the given diagram using, couplings, unions, reducer & bends.
   b. To connect the GI pipes as per the given diagram using shower, tap & valves and Demonstrate by giving water connection

Group- 2

1. To Study the method of Additive Manufacturing process using a 3D printer
2. To create a 3D CAD model of a door bracket using a modeling software
3. To Print a door bracket using an extruder type 3D Printer
4. To create a 3D CAD model by reverse Engineering
5. To Design an innovative component using the CAD software
6. To Print the selected innovative component by the students using a 3D printer

TEXT BOOKS:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Elements of Workshop Technology, Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Kalpakjian S. And Steven S. Schmid, Manufacturing Engineering and Technology. 4th edition, Pearson Education India Edition, 2002.
3. Sachidanand Jha, 3D PRINTING PROJECTS: 200 3D Practice Drawings For 3D Printing On Your 3D Printer, June 7, 2019.

SUGGESTED READING:

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

With effect from the Academic Year 2021-22

20MTC08

PARTIAL DIFFERENTIAL EQUATIONS AND STATISTICS

(For CIVIL/MECH/PROD/CHEM)

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

Course Objectives:

1. To learn Numerical solution of ODE and Engineering problems.
2. To form PDE and to find its solution.
3. To know the model of wave and heat equations.
4. Able to fit the hypothetical data using probability distribution.
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. Find solution of initial value problems of ODE by Numerical Method.
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.

UNIT-I: 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.

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

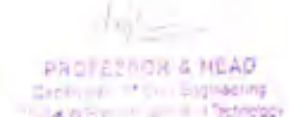
Poisson distribution,MGF and Cumulants of the Poisson distribution, Normal distribution, characteristics of Normal distribution MGF and CGF of Normal distribution, Areas under normal curve. Correlation, Coefficient of Correlation and Lines of Regression. Curve fitting by the Method of Least Squares,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



With effect from the Academic Year 2021-22

20CE 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:

At the end of the course the student should have learnt

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

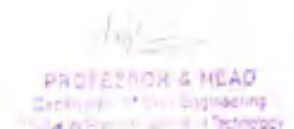
PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	1												
CO 2	2	1	2												
CO 3	2	1													
CO 4	2	1	1	1											
CO 5	2	1	1	1											

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.

References

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.

PROFESSOR & HEAD

With effect from the Academic Year 2021-22

20CE 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												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
2	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
3	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
4	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
5	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2

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.

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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.

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With effect from the Academic Year 2021-22

20CE C05

FLUID MECHANICS

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

Course Objectives:

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 student should have learnt

1. To evaluate the various properties of fluid, analyse 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1									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 weir

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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.

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With effect from the Academic Year 2021-22

20CE C06

BUILDING CONSTRUCTION PRACTICE & CONCRETE TECHNOLOGY

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 study about the traditional building materials, properties and their applications.
2. To learn the properties & conduct tests on various ingredients of concrete.
3. To understand various properties of fresh and hardened concrete.
4. To understand the concepts of building planning and various practices adopted and different types of roofs, doors, windows and stairs.
5. To understand different types of masonry, types of bonds used in construction of walls of buildings.

Course outcomes: At the end of the course the student is able
1. To identify the traditional building materials and select suitable type for given situation.
2. To determine the properties of the ingredients of concrete and adjudge their suitability.
3. To know various properties of fresh and hardened concrete.
4. To know the concepts of building planning and various practices adopted and different types of roofs, doors, windows and stairs.
5. To know different types of masonry, types of bonds used in construction of walls of buildings.

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

UNIT- I:
Traditional Building Materials: Properties, Types, Applications and testing of traditional building materials - Stone, Timber, Brick, Paints, Varnishes and distempers.
Introduction to new materials/composites: Plastics, Tiles, AAC Blocks, CLC Blocks

UNIT- II:
Concrete Materials: Manufacturing process of cement, properties of cement, types and tests conducted on cement - Properties of aggregate (Fine & coarse) and tests on aggregate (Fine & coarse) – Properties and tests on cement mortar.
Production of concrete: batching, mixing, transportation, handling, placing and curing of concrete & methods of curing. Water cement ratio, Gel space ratio.

UNIT- III:
Influence of constituent materials on Fresh concrete: Segregation and bleeding of concrete - Workability, factors affecting workability, measurement of workability using slump cone and compaction factor tests.
Hardened concrete: Behaviour of concrete under compression - M
Concrete Mix Design: Basic considerations - Factor to be conside I.S. code method of mix design

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UNIT- IV:

Concepts of Building Planning: Types of Buildings as per National Building Code, Functional needs and differences in their planning requirements – **Principles of Planning - Building Byelaws – Planning of a building with byelaws - Plumbing services – HVAC services – Formwork & Shuttering – Plastering & Pointing** - Types of roofs, doors, windows and staircases – Representation of Building materials and Plumbing services.

UNIT- V:

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& Flemish Bond – for half brick, one & 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.

Text Books:

1. S.P. Arora & S. P. Bindra, "*A text book of Building Construction*", Dhanpat Rai Publications, 2010.
2. B.C Punmia, Ashok Kumar Jain &Arun Kumar Jain "*Building Construction*", Laxmi Publications (P) LTD, 2016.
3. A.M Neville., "Properties of Concrete", Pearson Education. 2012.
4. M.S. Shetty, and A. K. Jain, "Concrete Technology: Theory and Practice", S. Chand & Company, 2018.
5. R. Santhakumar, "Concrete Technology", Oxford University, Press 2018.

Suggested Reading:

1. P.C. Varghese, "*Building construction*" PHI, 2016.
2. CBRI Roorkee, "*Advances in Building Materials and construction*".
3. Sushil Kumar, "*Building Construction*", Standard Publishers, 1992.
4. National Building Code of India, 2006.

PROFESSOR & HEAD

With effect from the Academic Year 2021-22

Code: 20EG M03

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

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

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

Introduction

This course discusses the role of human values in one's family, in society and in nature. In 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

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes

By the end of the course,

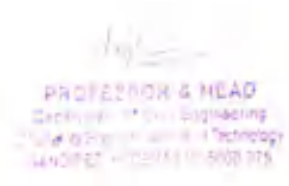
1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

The course has 28 lectures and 14 practice sessions:

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

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



Unit 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

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

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

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 with scenarios. Elicit examples from students' lives

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space
- Holistic perception of harmony at all levels of existence.

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.

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- 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
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  b. At the level of society: as mutually enriching institution[illegible]

Include practice Exercises and Case Studies will be taken up in Pr[illegible] To discuss the conduct as an engineer or scientist etc.

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With effect from the Academic Year 2021-22

Mode of Conduct (L-T-P-C 2-1-0-3)

- Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.
- While analysing 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 mentor, in a group sitting.
- Tutorials (experiments or practical) are important for the 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 (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

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:
Assessment by faculty mentor: 10 marks
Self-assessment/Assessment by peers: 10 M
Socially relevant project/Group Activities/Assignments: 20 marks
Semester End Examination: 60 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Text Books

The Text Book

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 The teacher's manual
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. A Nagaraj Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Cecile Andrews, Slow is Beautiful
4. Gandhi - Romain Rolland (English)
5. Dharampal, "Rediscovering India"
6. E. FSchumacher. "Small is Beautiful"
7. J. C. Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
10. 10.Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. Maulana Abdul Kalam Azad, India Wins Freedom -
12. Vivekananda - Romain Rolland (English)
13. The Story of Stuff (Book)

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With effect from the Academic Year 2021-22

20CE C07

SOLID MECHANICS LAB

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

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												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
2	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
3	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
4	3	2	1	2	1	1	-	1	1	1	1	1	3	2	1
5	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 M*

PROFESSOR & HEAD

With effect from the Academic Year 2021-22

20CEC08 **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 enable the student understand the governing parameters for the discharge measurement for flows through various measuring devices.
2. To verify the flow and velocity measurements by conducting different tests.
3. To understand Bernoulli's principle by conducting experiment.
4. To understand Hydrostatic forces on flat and curved surfaces by conducting experiments.
5. To understand stability of floating bodies by conducting experiments.
6. To enable the student to understand viscosity.

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

1. Ability to find the co-efficient of discharge for flows through various flow measuring devices.
2. To differentiate between laminar and turbulent flows and identify the governing parameters for both.
3. Applies the concept of Bernoulli's energy principle.
4. Applies the concept of hydrostatic forces on flat and curved surfaces.
5. Ability to find the stability and metacentre of floating body.
6. To differentiate between viscous and non-viscous flows and identify the governing parameters for both.

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1							1				1		1
CO2	3	1							1				1		1
CO3	3	1							1				1		1
CO4	3	1	1						1				1		1
CO5	3	1	1						1				1		1
CO6	3	1							1				1		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.

PROFESSOR & HEAD

With effect from the Academic Year 2021-22

20CE C09

HYDRAULIC ENGINEERING

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60Marks
CIE	40Marks
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 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO9	PO10	PO11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1										2		
CO2	3	2	1										2		1
CO3	3	2	2										2		1
CO4	3	2	2										2		1
CO5	3	2	2										2		1

UNIT–I:

Uniform flow through open channels: Differences between pipe flow and channel flow, velocity and pressure distributions in channel cross-section, energy and momentum correction coefficients, uniform flow. Manning and Chezy formulae, most efficient channel cross-section, specific energy and specific force, concept of critical depth and its applications.

UNIT–II:

Non-uniform flow through open channels: Critical flow, Significance of Froude Number, dynamic equation of gradually varied flow, classification of gradually varied flow profiles and computation of flow profiles.

Hydraulic Jump- Momentum equation for a jump in horizontal rectangular channel, energy dissipation in hydraulic jump. Introduction to surges.

UNIT–III:

Boundary layer-Definition, laminar and turbulent boundary layers, boundary layer thickness, displacement thickness, momentum thickness and energy thickness, hydro dynamically smooth and rough boundaries, boundary layer separation and control.

Drag and lift: Fundamental concepts of drag and lift forces. Drag on sphere, cylinder, flat plate and aerofoil. Principles of streamlining, Magnus effect.

PROFESSOR & HEAD

UNIT-IV:

IMPACT OF JETS: Hydrodynamic force 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, 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.

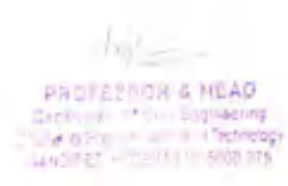
Centrifugal Pumps: Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pumps, Pumps in series and parallel.

Text Books:

1. P.N.ModiandS.M.Seth,"*HydraulicandFluidMechanics*",StandardBookHouse,Delhi,2013.
2. K.Subramanya,"*FlowinOpenChannels*",TataMcGraw-HillEducation,2009.

Suggested Reading:

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



With effect from the Academic Year 2021-22

20CE C10

SURVEYING II

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 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.

PO/ PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
20CEC09.1	2	2													
20CEC09.2	2	2													
20CEC09.3	2	2			1										
20CEC09.4	2	2			1										
20CEC09.5	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.

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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

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.

PROFESSOR & HEAD

With effect from the Academic Year 2021-22

20CE 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												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
2	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
3	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
4	3	2	1	-	-	-	-	-	-	-	-	1	3	1	2
5	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.

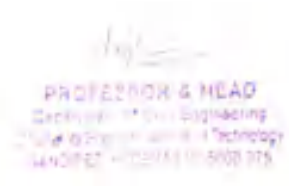
UNIT - II:

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.



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.

PROFESSOR & HEAD

20CE C12

REINFORCED CONCRETE DESIGN – I

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

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, 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.

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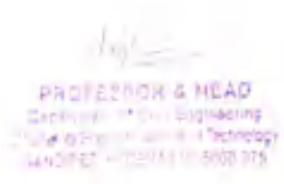
UNIT - V: Analysis and design of columns as per IS 456: Short and long columns - End conditions, effective length of columns - assumptions made in design - design and detailing of axially loaded rectangular and circular columns with lateral reinforcement - Design of axially loaded short columns subjected 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.



With effect from the Academic Year 2021-22

PROFESSIONAL ELECTIVE-I

20CE E01

GREEN BUILDING TECHNOLOGIES

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

Course Objectives: To enable the student

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.

	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 r energy management. Certification- Study of the LEED and TERI (GRIHA) parameters a ldings

PROFESSOR & HEAD

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.
3. Regina Leffers*, "Sustainable Construction and Design*", Pearson / Prentice Hall, USA, 2009.

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With effect from the Academic Year 2021-22

20CE E02

PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEM

Instruction	3L Hours per week
Duration of Semester End Examination	3 hours
SEE	60Marks
CIE	40Marks
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
5. 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.
5. Is able to apply the Cartographic modelling techniques for Watershed modeling, Environmental Modeling and for Watershed Management, visibility analysis..

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	2	2					2	2	2			
CO 2	2	2			2										
CO 3	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 comp , Relational data base , object based data models Concepts of Geo referencing, Existing di abase. 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. I. 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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With effect from the Academic Year 2021-22

20CE E03

SOLID AND HAZARDOUS WASTE MANAGEMENT

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 legislations on management of solid waste management.
2. Gain insight into the transfer, transport and energy recovery from municipal solidwaste.
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: At the end of the course, student is able to

1. Characterize the solid waste according to thelegislations.
2. Apply the steps in waste reduction at source, collection techniques, resource recovery/recycling, transport and disposal options.
3. Characterize the hazardous waste and decide on transport methods of the same.
4. Select the site for disposal of hazardous waste and suggest remediation measures for disposal sites.
5. Applyvariouslegislationspertainingtohazardouswastemanagement according to the situations.

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

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 Solidwaste: Separationand Processingand 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- Land farming, deep well injections, 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, ment, Hazardous waste landfills: Site selection, remediation of hazardous waste dispos essment, containment, remedial alternatives.

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UNIT –V:

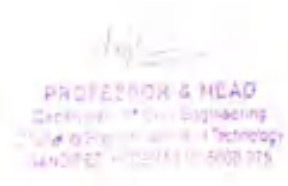
Environmental regulations: Environmental audit, Pollution Prevention, Facility Development and operation. Hazardous waste – legislations – RCRA process – superfund process – toxicological principles – dose response – toxic effects – toxic response

Text Books:

1. P. A. Vesilind, Worrell W and Reinhart, "*Solid Waste Engineering*", 2nd Edition (2016), Cengage Learning India Pvt. Ltd.
2. Tchobanoglous,"*Integrated Solid Waste Management"*, Mc-Graw Hill International 1st Edition, New York, 2014."
3. Charles A. Wentz; "*Hazardous Waste Management*", McGraw Hill Publication, 1995.

Suggested Reading:

1. CPHEEO, "*Manualon Municipal Solidwaste management"*, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans, "*Hazardous waste Management*", Waveland Pr. Inc, 2010
3. C. A. Wentz, "*Hazardous Waste Management*", McGraw-Hill Publication, 1995.
4. A. D. Bhide and B. B. Sundaresan, "*Solid Waste Management, Collection, Processing and Disposal*", Nagpur.
5. S.C. Bhatia, "*Solid and Hazardous waste management*", Atlantic publishers, 2007.



With effect from the Academic Year 2021-22

20CE E04

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: The student should able to understand

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 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	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 – Her[illegible] – salt water interface, Length of the intruded sea water wedge. Prevention and control of

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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.

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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20CE C13 **Computer Aided Civil Engineering Drafting**

Instruction	1T+3P Hours per week
Duration of Semester End Examination	3 hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Outcomes: At the end of the course, using the basic tools of Autocad - the student will 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.

	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.

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With effect from the Academic Year 2021-22

20CEC14

HYDRAULIC ENGINEERING LAB

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

Course Objectives: To enable the student

1. Understand uniform and non-uniform flows and the importance of Froudenumber in open channel flows.
2. Determine super elevation in a curved channel.
3. Determine the force exerted by fluid jet on vane, determine efficiency and performance of turbines and centrifugal pumps.
4. To measure the discharge in a open channel.

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

1. To compute the open channel rugosity coefficient in uniform flows and Froude number, energy losses in non-uniform flows.
2. To differentiate between uniform, non-uniform flows and flow in curved channel.
3. To determine work done by fluid jet on vane, compute work done and draw performance characteristic curves for turbines and centrifugal pumps.
4. To determine the coefficient of discharge of a venturi flume.

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1						1				1		1
CO2	3	1							1				1		1
CO3	3	1	1						1				1		1
CO4	3	1							1				1		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 ofjump.
4. Venturiflume - 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

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With effect from the Academic Year 2021-22

20CE C15

SURVEYING AND GEOMATICS LAB

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

Course Objectives: To enable the student

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.

PO/ PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
20CEC14 .1	2	1	1						1						
20CEC14 .2	2	1	2						1			1			
20CEC14 .3	2	1	2						1						
20CEC14 .4	2	1	1	1					1						
20CEC14 .5	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 softwa

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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.

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With effect from the Academic Year 2021-22

20EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(BE/BTech III/IV Semester - Common to all branches)

Instruction	2L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	0

Course Objectives

The course will introduce the students to:

1. History of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Growth of Indian opinion regarding modern Indian intellectuals constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Various Organs of Governance and Local Administration.

Course Outcomes

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

1. Understand the making of the Indian Constitution and its features.
2. Identify the difference among Right To equality, Right To freedom and Right to Liberty.
3. Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
4. Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
5. Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.

Unit-I

Constitution of India: Constitutional history-Govt of India Act 1909, 1919 and 1935, Constitution making and salient features. Directive Principles of State Policy - Its importance and implementation.

Unit-II

Scheme of the Fundamental Rights & Duties: The Fundamental Rights - To Equality, to certain Freedom under Article 19, to Life and Personal Liberty Under Article 21. Fundamental Duties - the legal status.

Unit III

Union Government and its Administration - Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India: Executive-President's role, power and position.

Unit IV

Legislature and Judiciary: Central Legislature-Powers and Functions of Lok Sabha and Rajya Sabha.

Judiciary: Supreme Court-Functions, Judicial Review and Judicial Activism

Unit V

Local Self Government - District's Administration Head (Collector): Role and Importance.

Municipalities: Introduction, Mayor and Role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: Position and Role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and Officials.

Text Books:

1. **Indian Government & Politics**, Ed Prof V Ravindra Sastry, Tel .018.
2. **Indian Constitution at Work,** NCERT, First edition 2006, Rep

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Suggested Reading:

1. **The Constitution of India**, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, **Framing of Indian Constitution**, 1st Edition, 2015.
3. M. P. Jain, **Indian Constitution Law**, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu**, Introduction to the Constitution of India**, Lexis Nexis, 2015.

Online Resources:

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

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With effect from the Academic Year 2021-22

20EGM02

INDIAN TRADITIONAL KNOWELDGE

Instruction	2L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	0

Prerequisite: Knowledge on Indian Culture

Course Objectives:

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

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

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Culture and Civilization: Culture, civilization and heritage, general characteristics of culture, importance of culture in human life, Cultural diversity, Aesthetics, Women seers, Indus culture, Indian cuisine, Martial arts

UNIT-II

Education System: Education in ancient, medieval and modern India, aims of education, subjects, Languages, Science and Scientists of ancient, medieval and modern India

UNIT-III

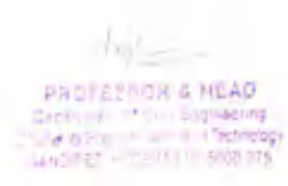
Linguistic Wealth: Indian Languages and Literature: the role of Sanskrit, Paleography, Significance of scriptures to current society, Indian semantics and lexicography, Bhakti literature, Darsanas

UNIT-IV

Art, Technology & Engineering: Sculpture, Painting and Handicrafts, Indian Music, Dance Drama and Theatre, Introduction to Mayamatam, Iron and steel technology, Use of metals in medicinal preparations

UNIT-V

Science and Logic: Helio-centic system, Sulbasutras, Katapayadi, Hindu calendar, 6 pramanas in Indian logic, Scientific method applied to therapeutics, Fallacies, Tarka – Induction &Deduction, Ayurvedic biology, Definition of health



Essential Readings:

1. Kapil Kapoor, **Text and Interpretation: The Indian Tradition,** ISBN: 81246033375, 2005
2. Samskrita Bharati, **Science in Samskrit**, ISBN-13: 978-8187276333, 2007
3. Satya Prakash, **Founders of sciences in Ancient Indi**a, Govindram Hasanand, ISBN-10: 8170770009, 1989
4. Brajendranath Seal, **The Positive Sciences of the Ancient Hindus**, Motilal Banarasidass, ISBN-10: 8120809254, 1915
5. Kancha Ilaiah, Turning the Pot, Tilling the Land: Dignity of Labour in Our Times

Suggested Readings:

- Swami Vivekananda, *Caste, Culture and Socialism*, Advaita Ashrama, Kolkata ISBN-9788175050280
- Swami Lokeswarananda, *Religion and Culture*, Advaita Ashrama, Kolkata ISBN-9788185843384
- Kapil Kapoor, *Language, Linguistics and Literature: The Indian Perspective*, ISBN-10: 8171880649, 1994.
- Karan Singh, *A Treasury of Indian Wisdom: An Anthology of Spiritual Learn*,ISBN: 978-0143426158, 2016
- Swami Vivekananda, *The East and the West*, Advaita Ashrama, Kolkata 9788185301860
- Srivastava R.N., *Studies in Languages and Linguistics*, Kalinga Publications ISBN-13: 978-8185163475
- Subhash Kak and T.R.N. Rao, Computation in Ancient India, Mount Meru Publishing ISBN-1988207126
- R.N Misra, *Outlines of Indian Arts Architecture, Painting, Sculpture, Dance and Drama,* IIAS, Shimla & Aryan Books International, ISBN 8173055149
- S. Narain, *Examinations in ancient India*, Arya Book Depot, 1993
- M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014
- Ravi Prakash Arya, Engineering and Technology in Ancient India, Indian Foundation for Vedic Science, ISBN-10: 1947593072020
- Shashi Tharoor, The Hindu Way
- Amartya Sen, Argumentative Indian

SWAYAM/Nptel:

History of Indian Science and Technology - https://onlinecourses.swayam2.ac.in/arp20_ap35/preview
Introduction to Ancient Indian Technology – https://onlinecourses.nptel.ac.in/noc19_ae07/preview
Indian Culture & Heritage - https://onlinecourses.swayam2.ac.in/nos21_sc11/preview
Language and Society - https://nptel.ac.in/courses/109/106/109106091/
Science, Technology & Society - https://nptel.ac.in/courses/109/103/109103024/
Introduction to Indian Philosophy - https://nptel.ac.in/courses/109/106/109106059/
Introduction to Indian Art - An appreciation - https://onlinecourses.nptel.ac.in/noc20_hs09/preview

20CE C16

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

1) Understand the types of highways, patterns, master plans, alignment finalization and components of highway projects.
2) Apply various IRC Standards for the Geometric design of highways.
3) Organize collection of traffic related data and analyzing the data for different applications
4) Apply the design concepts to flexible and rigid pavements as per IRC standards.
5) Execute construction of pavements as per IRC standards and evaluate of pavement condition to recommend suitable remedial measures.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
2	1	1	1	1	-	-	-	-	-	-	2	1	-	2	2
3	3	2	3	1	-	-	-	-	-	-	2	1	1	2	2
4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	2
5	1	1	1	-	-	-	-	-	-	-	-	-	-	1	1
AVERAGE	2.2	1.6	1.6	1	-	-	-	-	-	-	2	1	1	1.6	1.8

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:

Pavement Design: Various properties of highway materials, pavement types, factors to be considered for pavement design, structural difference between flexible and rigid pavement design. Flexible pavement design (IRC - 37: 2018), design wheel load, ESWL, EALF. IRC cumulative standard axles method.

Rigid pavement design (IRC 58-2015): Concepts -radius of relative stiffness, Modulus of subgrade reaction and other characteristics of concrete, wheel load stresses analysis by Westergaard's temperature stresses and critical combination of stresses. Longitudinal and transverse joints, contraction joints, expansion joints, and construction joints.

UNIT- V:

Pavement Construction and Maintenance: Construction of WBM roads and WMM roads, types of bituminous construction- interface treatment, bituminous surface dressing, seal coat, penetration macadam, built up spray grout, pre-mix methods, bituminous pre-mix carpet, bituminous concrete, bituminous sheet asphalt, mastic asphalt. Construction procedures – surface dressing, penetration macadam, bituminous bound macadam and bituminous concrete. Construction of cement concrete pavements and construction of joints. Pavement distress, failures of flexible and rigid pavements and remedial measures.

Text books:

1) S. K. Khanna, C. E. G. Justo, and A. Veeraraghavan, "*Highway Engineering*", revised 10th Edition, Nem Chand & Bros., 2017.
2) L. R. Kadiyali, "*Traffic Engineering and transport planning*", Khanna Publishers.2011.
3) S.K. Sharma, "Principles, Practice and Design of Highway Engineering", S. Chand Publishers, 2015.
4) R. Srinivas Kumar, "*Transportation Engineering*", Universities Press, 2020

Suggested Reading

1) Fred L. Mannering and Scott S. Washburn, "*Principles of Highway Engineering and Traffic Analysis*", 4thEdition, John Wiley. 2007
2) R. Srinivas Kumar," *Pavement Evaluation, Maintenance and Management systems*", Universities Press, 2014.
3) L. A. Garber and N. J. Hoel, K. RamachandraRao, "*Traffic and Highway Engineering*, 5th Edition, 2017. Cengage learning India Pvt. Ltd., New Delhi
4) R. Srinivasa Kumar, "Textbook *of Highway Engineering*", Universities Press, 2011.
5) Dr. L.R. Kadiyali and Dr. N.B. Lal, "Principles and Practices of Highway Engineering", Khanna Publishers. 2018
6) IRC 37:2018, "Flexible pavement design".
7) IRC 58:2015, "Rigid pavement design".

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DEPARTMENT OF CIVIL ENGINEERING
CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
GANDIPET, HYDERABAD - 500 075

R20 CE C17

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 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, stresses in soils under various soil conditions and compute discharge in soil.
3) Modify the properties of soil by using various compaction methods and compute the settlement of compressible soils.
4) Estimate the shear strength of different soils under various loading conditions.
5) Evaluate earth pressures and slope stability under different field conditions.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
2	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
3	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
4	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
5	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
Average	3	1	-	-	-	-	-	-	-	-	-	-	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, 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 (c)& Cohesive & soils and c-ø soils; Coulomb"s Wedge theory; Rehhann"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, 2009
2) B. C. Punmia, A. K Jain, and A. K. Jain "Soil Mechanics and Foundations", Laxmi Publications; Sixteenth edition, 2017.

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) GopalRanjan, "Basic and Applied Soil Mechanics", New Age International Pvt Ltd; Third Edition 2016.
4) C.Venkatramaiah, "Geotechnical Engineering", New Age Publications, revised Fifth edition, 2017.
5) B. M. Das and K. Sobhan, "Principles of Geotechnical Engineering", NPTEL study material.
6) IS 2720-11: Methods of test for soils. Part 11: Determination of the shear strength parameters of a specimen tested in unconsolidated undrained triaxial compression without the measurement of pore water pressure.

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20CE C18

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

1) Develop the ILD's for reactions, shear force and bending moment at a section, determine the maximum SF and BM for various positions of the moving point loads and uniformly distributed loads.
2) Construct the ILD's for forces in the members of trusses and evaluate the maximum forces for various positions of the moving point loads and uniformly distributed loads.
3) Apply slope – deflection method for indeterminate beams with and without sinking of supports subjected to point loads and udl on the entire span and analyse rigid jointed plane frames with and without lateral sway using slope deflection method.
4) Apply moment distribution method for indeterminate beams with and without sinking of supports subjected to point loads and udl on the entire span and analyse rigid jointed plane frames with and without lateral sway using moment distribution method.
5) Apply matrix, flexibility and stiffness method to continuous beams.

Articulation Matrix:

COs	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-	-	-	-	-	-	-	1	3	2	-
2	3	2	-	-	-	-	-	-	-	-	-	1	3	2	-
3	3	2	-	-	-	-	-	-	-	-	-	1	3	2	-
4	3	2	-	-	-	-	-	-	-	-	-	1	3	2	-
5	3	2	-	-	-	-	-	-	-	-	-	1	3	2	-
Average	3	2	-	-	-	-	-	-	-	-	-	1	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 diagrams.

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
4) D. S. Prakash Rao, "Structural Analysis" - A Unified Approach, University Press, 2012

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20CE C19

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

1) Understand the material properties, loads and design philosophies, design bolted and welded connections.
2) Know, how yielding & buckling takes place, design simple and built-up compression members and column bases
3) Understand the modes of failure of tension members ,design tension members using limit state method ,design tension and compression members using working stress method as per IS: 800-2007
4) Classify structural steel sections, distinguish between laterally supported and laterally unsupported beams, designsimple flexural members including secondary considerations
5) Estimate the loads on roof trusses and design purlins and members of trusses

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	1	-	-	-	-	-	-	-	1	3	3	-
2	3	3	3	2	-	-	-	-	-	-	-	1	3	3	-
3	3	3	3	2	-	-	-	-	-	-	-	1	3	3	-
4	3	3	3	2	-	-	-	-	-	-	-	1	3	3	-
5	3	3	3	2	-	-	-	-	-	-	-	1	3	3	-
Average	3	3	3	1.8	-	-	-	-	-	-	-	1	3	3	-

UNIT – I:

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

Design Philosophies: Working Stress Method, Limit State Method, Loads and Load Combinations, Partial safetyfactors 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 - ConcentricConnections and Eccentric Connections, Introduction to High Strength Friction Grip Bolted connections.

Welded Connections (Limit State Method): Types of Welds, Lap and Butt Joints- strength of welded joints - designof 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 and Gusset Bases.

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, Shape factor; 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.

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20CE C20

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 Outcomes: The student will be able to

1) Conduct various tests on bitumen, define its quality and decide its suitability for its use in pavements.
2) Conduct various tests on aggregates, define its quality and decide its suitability for its use in roads.
3) Organize various traffic studies and analyze the data by applying statistical tools.
4) Prepare representative samples for various tests on aggregates
5) Generate technical report based on the studies carried in the laboratory and field studies.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	2	-	-	-	-	-	-	-	-	1	-	2
2	2	2	2	2	-	-	-	-	-	-	-	-	1	1	-
3	2	1	1	2	-	-	-	-	-	-	-	-	-	1	2
4	2	1	1	-	-	-	-	-	-	-	-	-	1	1	1
5	2	1	1	2	-	-	-	-	-	-	-	-	1	1	1
Average	2	1.4	1.4	2	-	-	-	-	-	-	-	-	1	1	1.5

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

6. Aggregate crushing value test
7. Los Angeles abrasion test
8. Aggregate impact value test
9. Aggregate shape test (flakiness & elongation)
10. Water Absorption test

C) Traffic Studies

11. Traffic volume study
12. Spot Speed study

D) Miscellaneous Tests (demonstration only)

13. Determination of CBR.
14. Preparation of representative sample by coning and quartering
15. Bitumen extraction test
16. 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

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20CE C21

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

1) Identify soils with reference to their characteristics.
2) Evaluate and classify soils according to IS classification.
3) Calculate seepage volume for different soils.
4) Examine methods to improve soil stability of soils.
5) Conduct tests according to IS laboratory standards and procedures

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
3	3	1	-	-	-	-	-	-	-	-	-	-	-	2	-
4	3	1	-	-	-	-	-	-	-	-	-	-	-	2	-
5	3	1	1	-	1	-	-	-	-	-	-	-	-	3	-
Average	**3**	**1**	**1**		**1**	-	-	-	-	-	-	-	**1.5**	**2.33**	-

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.
4) K. H. Head K.H."Manual of Soil Laboratory Testing"-, (1986)- Vol. I, II, III, Princeton Press, London.

5) S. J. E. Bowles J.E". Properties of Soil and Their Measurements",. (1988), - McGraw Hill Book Co. New York.
6) https://smfe-iiith.vlabs.ac.in/List%20of%20experiments.html
7) http://home.iitk.ac.in/~madhav/geolab.html

20CE 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 Outcomes: At the end of the course, student is able to

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

	POs												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	-	-	-	-	-	3	-	-	-	-	1	1	-	-
2	1	-	-	-	-	-	2	1	-	-	-	1	1	-	-
3	1	-	-	-	-	-	2	1	-	-	-	1	1	-	-
4	1	-	-	-	-	1	2	1	-	-	-	1	1	-	-
5	1	-	-	-	-	1	2	1	-	-	-	1	1	-	-
Aver	1	-	-	-	-	1	2.2	1	-	-	-	1	1	-	-

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

20CE E05

APPLICATION OF ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING

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

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

1) Recall fundamental knowledge on artificial intelligence.
2) Understand neural networks and their types and apply neural networks in the domain of civil engineering.
3) Understand 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 civilengineering.
5) Develop a regression models for civil engineering problems.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-
2	1	1	1	-	2	-	-	-	-	-	-	1	1	-	-
3	1	1	1	-	2	-	-	-	-	-	-	1	1	1	-
4	1	1	1	-	2	-	-	-	-	-	-	1	-	1	-
5	1	1	1	-	2	-	-	-	-	-	-	1	1	1	-
Average	1	1	1	-	2	-	-	-	-	-	-	1	1	1	-

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: At in Civil Engineering, 2012.
2) Ian Flood, Nabil Kartam, Artificial Neural Networks for Civil Engineers: advanced features and applications, 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.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

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20CE 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 outcomes: At the end of the course, Students will be able to

1) Understand the general mechanism of pre stressed concrete members, types of pre stressing
2) Analyze and understand the behaviour of pre shessed concrete beams.
3) Identify and apply design concepts for the pre stressed concrete beams under flexure and shear.
4) Analyze the stresses in anchorage zones and design the end anchorages.
5) Understand the fundamental concepts of primary and secondary moments in continuous beams.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	1	-	-	-	-	-	-	-	1	1	1	1
2	2	2	1	1	-	-		-	-	-	-	1	1	1	-
3	2	2	3	2	-	-	-	-	-	-	-	1	1	-	-
4	2	2	3	2	-	-	-	-	-	-	-	1	-	-	-
5	2	2	3	2	-	-	-	-	-	-	-	1	1	1	1
Average	2	2	2.2	1.6								1	1	1	1

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:

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 III:

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- 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, 2018
2) G.S. Pandit and S.P. Gupta, "Prestressed Concrete", CBS Pub., 2009

Reference Books:

1) Arthur H. Nilson by "Design of Prestressed Concrete", John Wiley, 1987
2) T.Y. Lin and Burn, "Design of Prestressed Concrete", Wiley India Private Limited, 2010, 52 53 18CE

20CE E07

HAZARDS AND MANAGEMENT

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

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

1) Identify and understand the fundamental terminologies in disaster management.
2) Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and non-structural mitigation measures.
3) Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems.
4) Analyze various mechanisms and consequences of human induced disasters.
5) Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1	2	2	2	2	1	2	2	2	1	1	1	1
2	1	1	2	2	2	3	3	1	2	1	1	1	1	1	-
3	2	2	2	2	2	2	3	2	1	1	2	1	1	-	-
4	2	2	2	2	3	2	1	1	1	1	1	1	-	-	-
5	2	1	2	1	2	3	1	2	2	2	2	1	1	1	1
Average	1.8	1.4	1.8	1.8	2.2	2.4	2	1.4	1.6	1.4	1.6	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) Ministry of Home Affairs, Government of India, National Disaster Management Plan, Part I and II
2) K.K. Ghosh, "Disaster Management", APH Publishing Corporation, 2006
3) http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
4) http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5) Hazards, Disasters and your community: A booklet for students and the community. Ministry of Home Affairs.
6) Disaster Medical Systems Guidelines, Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
7) Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings, Geneva: IASC.
8) http://ndma.gov.in/ (Home page of National Disaster Management Authority)

PROFESSOR & HEAD
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
GANDIPET, HYDERABAD - 500 075

20CE E08

DESIGN OF 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 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 and factors affecting compressive strength of masonry units.
2) Explain 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 seismic safety of unreinforced and reinforced masonry walls

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	1	-	3	-	1	-	-	-	1	2	2	1
2	2	2	1	1	-	3	-	1	-	-	-	1	2	2	1
3	2	2	1	1	-	3	-	1	-	-	-	1	2	2	1
4	2	2	1	1	-	3	-	1	-	-	-	1	2	2	1
5	2	2	1	1	-	3	-	1	-	-	-	1	2	2	1
Average	2	2	1	1	-	3	-	1	-	-	-	1	2	2	1

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) A. W. Hendry, B. P. Sinha and S. R. Davies. An introduction to load bearing brickwork design.
4) Sven Sahlin. Structural Masonry, Prentice-Hall Inc., 1971 4. Miha Tomeževic, Earthquake resistant design of masonry buildings, Imperial College Press, 1999, 693.852N99
5) Robert Drysdale and A A Hamid, Masonry structures behaviour and design, Publisher; The Masonry Society, Boulder, Colorado USA. 3rd Ed. 2008

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20EE O02

ENERGY MANAGEMENT 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

Prerequisites:

Students should have prior knowledge on different energy generation systems, basic idea about audit instruments.

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

1. Know the current Energy Scenario and importance of Energy Conservation.
2. Understand the concepts of Energy Management, Energy Auditing.
3. Interpret the Energy Management methodology, Energy security and Energy Strategy .
4. Identify the importance of Energy Efficiency for Engineers and explore the methods of improving Energy Efficiency in mechanical systems, Electrical Engineering systems
5. Illustrate the Energy Efficient Technologies in Civil and Chemical engineering systems

CO-PO/PSO ARTICULATION MATRIX

	POs												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	-	-	1	-	1	2	1	-	-	-	1	-	-	-
2	2	1	1	1	-	1	2	1	-	-	-	1	-	-	-
3	2	2	2	1	-	1	2	1	-	-	-	1	-	-	-
4	2	2	1	2	2	1	2	1	-	-	-	1	-	-	-
5	1	1	2	1	1	1	2	2	-	-	-	1	-	-	-
Average	1.6	1.5	1.5	1.2	1.5	1	2	1.2	-	-	-	1	-	-	-

UNIT-I

Various form of Energy and its features: Electricity generation methods using different energy sources such as Solar energy, wind energy, Bio-mass energy, and Chemical energy such as fuel cells. Energy Scenario in India, Impact of Energy on economy, development, and environment sectors of national and international perspective.

UNIT-II

Energy Management-I: Defining Energy Management, need for Energy Management, Energy management techniques, importance of Energy Management, managing the Energy consumption, Energy Audit and Types, Energy Audit Instruments.

UNIT-III

Energy Management-II: understanding Energy costs, bench marking, Energy performance, matching energy use to requirement, optimizing the input, fuel & Energy substitution, material and Energy balance diagrams, Energy pricing, Energy and Environment, Energy Security

UNIT-IV

Energy Efficient Technologies-I: Importance of Energy Efficiency for Engineers, Energy Efficient Technology in Mechanical engineering: Compressed Air System, Heating, ventilation and air-conditioning, Fans and blowers, Pumps and Pumping Systems.

Energy Efficient Technology in Electrical engineering: Automatic Power Factor Controllers, Energy Efficient Motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, space cooling, energy efficiency of lifts and escalator, energy saving potential of each technology.

UNIT-V

Energy Efficient Technologies-II: Energy Efficient Technology in Civil Engineering: Intelligent Buildings, And Various Energy Efficiency Rating Systems for Buildings, Green Buildings Energy Efficiency management of green buildings, importance of embodied energy in selection of sustainable materials, green building design, waste reduction/recycling, rainwater harvesting, maintenance of the green buildings, green building certification, Renewable energy applications.

Energy Efficient Technology in Chemical Engineering: Green chemistry, Low carbon cements, recycling paper.

Textbooks:

1. Umesh Rathore, 'Energy Management', Kataria publications, 2nd edition, 2014.
2. G Hariharaiyer, "Green Building Fundamentals", Notion press.com
3. K V Sharma, P Venkataseshaiah, "Energy management and conservation", I. K. International Publishing agency pvt. ltd., 2011. ISBN: 978-93-81141-29-8

Suggested Reading:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-I, General Aspects
2. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.
3. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

20ME OI2

3D PRINTING

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

Objectives:

1. To make students understand the basic concept of digital manufacturing.
2. To teach different processes involved in digital fabrication of products.
3. To demonstrate the STL file generation and manipulations.
4. To demonstrate various post processing techniqnes.
5. To demonstrate the applications of RP in different fields of engineering.

Onteomes: At the end of the course, the students are able to

1. Understand the concept of 3D printing processes, advantages and limitations.
2. Evaluate real-life scenarios and recommend the appropriate 3D printing technology.
3. Analyze various pre-processing and post processing techniques.
4. Explain cotrent and emerging 3D printing technologies in diversified applications.
5. Identify components required in construction of3Dprinter.

UNIT-I

Introduction to 3D Printing: Introduction to 3D printing, evolution, distinction between 3D printing & CNC machining.

Design considerations: Materials, size, resolution, mass customization. additive vs. subtractive manufacturing, its advantages and limitations

UNIT-II

Photo polymerization processes: Photo polymerization, Stereolithography Apparatus (SLA), Applications, advantages and disadvantages.

Powder bed fusion processes: Introduction, Selective laser Sintering (SLS), Materials, Applications, advantage and disadvantages.

Extrusion-based systems: Fused deposition modeling (FDM), laminated object manufacturing (LOM), Principles. Materials, Process Benefits and Drawbacks.

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

UNIT-III

Pre processing in AM: Modeling and viewing - 3D scanning; Model preparation – STL conversion, STL error diagnostics, STL file Repairs, generic solution, slicing, newly proposed file formats.

Post processing in AM: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non–thermal and thermal techniques.

UNIT-IV

Construction of basic 3D printer: Construction of 3D printing machine – axes, linear motion guide ways, ball screws, motors, bearings, encoders, process chamber, safety interlocks, sensors.

UNIT-V

Applications of AM: Application in aerospace industry, automotive industry, jewelry industry, coin industry, medical and bioengineering applications: planning and simulation of complex surgery, forensic science.

Text Books:

1. Gibson, DW. Rosen and B.Stucker; Additive manufacturing methodologies: Rapid prototyping to direct digital manufacturing, Springer, 2010.
2. Chee Kai Chua. Kah Fai Leong. 3D printing and additive manufacturing: principles and application. 4 th edition of rapid proto typing, World scientific publishing company, 2014.
3.P.K. Venuvinod, Rapid prototyping – Laser based and other technologies, Kluwer, 2004.

Suggested Reading:

1. Jacob, Paul, Rapid tooling: Technologies and industrial applications, Taylor & Francis Group, 2000.
2. Alain Bernard, Georges Taillandier, Additive Manufacturing, Wiley, 2014.

20EC O02

BASICS OF DIGITAL SIGNAL PROCESSING

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

Prerequisite: Basic concepts of signals are required

Course Objectives:

This course aims to:

1. Learn the advantages of DSP over analog signal processing.
2. Analyze discrete-time signals in the frequency domain using DFT and FFT.
3. Learn the theory of digital filters

Course Outcomes:

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

1. Understand the concept of Discrete time signals and systems
2. Analyze the frequency domain representation of discrete dme seqnence using DTFT and DFT.
3. Apply FFT to the given sequence.
4. Implementation of FIR filter for the given specifications
5. Design an IIR filter for the given specifications.

Course Articulation Matrix:

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	03	03	03	02	03	02	-	-	02	02	-	02	03	03	02
2	03	03	03	02	02	02	-	-	02	02	-	02	03	03	02
3	03	03	03	02	03	02	-	-	02	02	-	02	03	03	01
4	03	03	03	02	02	02	-	-	02	02	-	02	03	03	02
5	03	03	03	02	03	02	-	-	02	02	-	02	03	03	02
Aver	3	3	3	2	2.6	2			2	2		2	3	3	1.8

UNIT-I

Discrete Time Signals and Systems: Introduction, basic elements of a digital signal processing system, advantages and disadvantages of Digital Signal Processing over Analog signal processing, sampling theorem, analog to digital and digital to analog conversion. Discrete-Time System: Mathematical representation of Discrete Time Systems, Concept of Impulse response and Transfer function, Linear and Time invariant systems, Concept of causality and stability.

UNIT-II

Frequency Domain Analysis of Discrete Time Sequences: Discrete Time Fourier Transform (DTFT), properties of DTFT. Discrete Fourier Transform (DFT) and its properties, relationship between DFT to the DTFT, circular convolution.

UNIT-III

Fast Fourier Transform (FFT): Introduction, Radix-2 Decimation –In- Time (DIT) and Decimation- In-Frequency (DIF) FFT algorithms, Bit reversal order, in-place computation.

UNIT-IV

FIR Filter Design: Characteristics of FIR filters, Linear phase filters, Design of FIR (LPF, HPF, BPF and BSF) filters using Truncation and Windows, Comparison between FIR and IIR filters.

UNIT-V

IIR Filter Design: Characteristics of IIR filters, Conversion from analog filters to digital filters using Impulse Invariance Method (IIM) and Bilinear Transformation (BLT) methods, prewarping. Realization diagrams-Direct form I & II.

Text Books:

1. Alan V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing," PHI, 2/e, 2010.
2. John G. Proakis&Dimitris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Application," PHI, 4/e. 2012.

Suggested Reading:

1. Sanjit K Mitra, " Digital Signal Processing", Tata Mc Graw Hill, Third edition, 2006
2. ChiTsnag Chen, "Digital Signal Processing", Indian edition, 2009.

No: CBIT/DEAL A79/2023, 14 Date: 27.10.23

REVISED ALMANAC 2023-24

Name of the Program: B.E./ B. Tech

Semesters: III to VI

III and V Semesters of BE/B. Tech

1	Commencement of class work	04.09.2023
2	Dasara Holidays	23.10.2023 to 28.10.2023
3	Class Test – I	30.10.2023 to 04.11.2023
4	Continuation of Class work	02.11.2023 to 16.12.2023
5	Last Date of Instruction	16.12.2023
6	Class Test – II	18.12.2023 to 26.12.2023
7	Preparation, Practicals and Semester End Examinations	27.12.2023 to 12.01.2024
8	Sankranti Holiday and Winter Vacation	13.01.2024 to 10.02.2024

IV and VI Semesters of BE/B. Tech

1	Commencement of class work	12.02.2024
2	Sadhbhav & Shruthi (Techno-cultural Spirit Fest)	26.02.2024 to 01.03.2024
3	Continuation of Regular Class Work	04.03.2024 to 01.04.2024
4	Class Test – I	02.04.2024 to 04.04.2024
5	Continuation of Regular Class Work	05.04.2024 to 20.05.2024
6	Last Date of Instruction	18.05.2024
7	Class Test – II	20.05.2024 to 22.05.2024
8	Preparation, Practicals and Semester End Examinations	23.05.2024 to 15.06.2024
9	Internship / Summer Vacation	17.06.2024 to 27.07.2024
10	Commencement of V and VII Semesters for the Academic Year 2024-2025 (tentatively)	29.07.2024

PRINCIPAL

Copy to:
All Advisors, Directors, Associate and Assistant Directors, Heads of the Departments/Sections
Head-HR & CoE and Library

CHAITANYA BHARATI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Stakeholder involvement in Curriculum Development AY 2022-23

Aetioo taken and implementation in Currieulum

Index

Students Feedback :

Sl. No.	Suggestions & Opinion	Actions Taken
1.	Feedback on POs achieved a moderate score in many criteria.	The following feedback received from students requires special attention focusing on improving the attainment of all 12 POs. Apart, from the Teaching-Learning Process, faculty were mottored to focus on the various aspects of defined POs to achieve the required attainment.
2.	A few areas in institute facilities received relatively lower ratings.	Efforts are being made to improve infrastructural facilities like Toilets, water quality, Internet accessibility etc.

Teachers :

S. No.	Suggestions & Opinion	Actions Taken
1	The scheme of evaluation aud Schedules is teo hectic for students.	The requirement of acheduling the Academic Calendar was addressed with the appropriate gap between the semesters for facilitating internships and other activities for students.

No.CBIT/ D-ACAD/2023/14

Date: 21.10.2023

REVISED ALMANAC 2023-24

Name of the Program: B.E. / B. Tech

Semesters: III to VI

III and V Semesters of BE/B. Tech		
1	Commencement of class work	04.09.2023
2	Dasara Holidays	23.10.2023 to 28.10.2023
3	Class Test - I	30.10.2023 to 01.11.2023
4	Continuation of Class work	02.11.2023 to 16.12.2023
5	Last Date of Instruction	16.12.2023
6	Class Test – II	18.12.2023 to 20.12.2023
7	Preparation, Practicals and Semester End Examinations	21.12.2023 to 12.01.2024
8	Sankranti Holiday and Winter Vacation	13.01.2024 to 10.02.2024

IV and VI Semesters of BE/B. Tech		
1	Commencement of class work	12.02.2024
2	Sudhee & Shruthi (Techno cultural Sports Fest)	26.02.2024 to 01.03.2024
3	Continuation of Regular Class Work	04.03.2024 to 01.04.2024
4	Class Test - I	02.04.2024 to 04.04.2024
5	Continuation of Regular Class Work	05.04.2024 to 18.05.2024
6	Last Date of Instruction	18.05.2024
7	Class Test – II	20.05.2024 to 22.05.2024
8	Preparation, Practicals and Semester End Examinations	23.05.2024 to 15.06.2024
9	Internship / Summer Vacation	17.06.2024 to 27.07.2024
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Head-HR & CoE and Librarian

Employers

S. No.	Suggestions & opinion	Actions Taken
1	Needs a focused approach in training students on design and execution of Pre-Engineered Buildings.	Site visits were planned to educate students and faculty to gain knowledge on the design and execution of pre-engineered buildings.
2	Courses with practical Orientation are to be Incorporated in the syllabus.	Practical skills in civil engineering courses has been introduced in the R20 Curriculum in the VIII Semester

20CE C34

PRACTICAL SKILLS IN CIVIL ENGINEERING

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

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

1. get the **ability to carry out land survey and quantity survey for various** structures.
2. be able to **read and interpret drawings of various structures.**
3. be able to **handle and manage various on site civil engineering activities.**
4. acquire ability to study and interpret R.C structural drawings and also be able to assess the structural health.
5. acquire ability to study and interpret R.C structural drawings and also be able to assess the structural health.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
2	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
3	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
4	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
5	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
Average	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2

UNIT -I:

Surveying: Preparation of Topo sheets - Identifying & locating strategic points on topo sheets - Hydrographic **surveying** - Quantity surveying for buildings, roads and earth work.

UNIT-II:

Drawing and detailing of Civil Engineering structures: Reading and interpretation of drawings pertaining to buildings, bridges and irrigation structures.

UNIT-III:

Building construction practices: Marking on site as per plans, Quality control checks - Related field tests - Planning and erection of form work - Execution /Coostruction planning M-book entries.

UNIT-IV:

Concrete Structures: Reading and interpretatioo of professional drawings of concrete structures (buildings, bridges, water tanks) - Detailing aspects - Detailed study of a distressed structure - NDT - Visit to a structure whioh is under retrofitting stage - Visit to a prefabricated structure.

UNIT V:

Steel Structures: Reading and interpretation of fabrication drawiogs and structural orawings of an industrial structure /any other steel structure. Detailed study of marking and execution of steel structure / industrial structure - Detailing of steel structures - Visit to an Industrial / Steel Structure.

Text Books:

1) Practical Civil Engineering by P.K. Jaya Sree, K Balan and V Rani, CRC Press (Taylor & Francis Group) 2021.

Suggested Reading:

1. Practical Civil Engineering, Hand Book by Ranul Nitin Gupta,

Alumni feedback

S. No.	Suggestions & opiniou	Actions Taken
1	More practical aspects bave to be incorporated into the syllabus to meet industry expectations	Practical skilis in civil engineering course has been introduced in the R20 Curriculum in the VIIi Semester
2	it is better to include programmiug /coding reiated courses has electives, so interested students get chance to learn such courses	Courses iike Basics of Macbine Learning, Python programming and ioT are introduced as Open elective iu VII semester in revised R20 Regulatiou.

20CE C34

PRACTICAL SKILLS IN CIVIL ENGINEERING

Instruction	2P Hours per week
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Semester End Examination	50 Marks
Continuous Internal Evaluation Marks	50
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COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
2	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
3	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
4	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
5	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2
Average	2	1	-	2	1	1	1	-	1	1	2	1	3	2	2

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AICTE Model Curriculum with effect from AY 2023-24

B.E (Civil Engineering)

SEMESTER-VII:

Sl No	Course code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in hours	Max marks		
			L	T	P		CIE	SEE	
1	20CE C28	Construction Engineering And Management	3	-	-	3	40	60	3
2	20MBC01	Engineering Economics and Accountancy	3	-	-	3	40	60	3
3	-	Professional Electives-4 (PE-4)	3	-	-	3	40	60	3
4	-	Professional Electives-5 (PE-5)	3	-	-	3	40	60	3
5	-	Open Electives - 3 (OE-3)	3	-	-	3	40	60	3
6	20CE C29	Concrete Technology Lab	-	-	2	3	50	50	1
7	20CE C30	Computer Applications Lab	-	-	2	3	50	50	1
8	20EGM03	Gender sensitization (MC)	2	-	-	3	-	50	NC
9	20CE C31	Project Part 1	-	-	4	-	50	-	2
10	20CE I03	Internship	4-6 weeks / 180 hours						3
		Total	17	-	8		350	450	22
		Clock Hours per week: 25							

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

Professional Electives-4 (PE-4)

20CE E13	Finite Element Methods
20CE E14	Applications of Data Analytics in Civil Engineering
20CE E15	Design of Hydraulic Structures
20CE E16	Concrete Technology & Special Concrete

Professional Electives-5 (PE-5)

20 CE E17	Railway and Airport Engineering
20CE E18	Applications of Block Chain Technology in Civil Engineering
20CE E19	Design of Steel Structures II
20CE E20	Advanced Environmental Engineering

Open Electives - 3 (OE-3)

20CS O07	Basics of Machine Learning
20AD O01	Introduction to Python Programming
20IT O02	Principles of IoT

3. 18CS O01 – Basics of Artificial Intelligence
4. 18EE O04 – Energy Conservation

18CE C24

CONSTRUCTION ENGINEERING AND MANAGEMENT

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the students

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. Analyse 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.

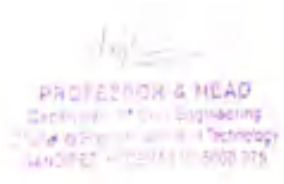
Course Outcomes: After completion of the course, students will be able to

1. choose a suitable type of construction method and project delivery system for successful project completion.
2. plan the construction project and apply a suitable technique for the project under consideration.
3. optimize project time and cost with the exercise of proper monitoring and control in construction projects
4. recall construction safety and quality management systems to be implemented in construction projects.
5. select proper equipment for the execution of various operations in construction and recall various issues of contracting.

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. Organisation – 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- Methodologies of WBS; estimating durations, sequence of activities, activity utility data; 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, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

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, and Precedence network. Schedule/time progress control; Cost control- Classification of costs, time-cost trade-off in construction projects; Implement



UNIT-IV:Construction Safety and Quality Management Safety: 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. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., Construction Technology, ELBS Publishers, 2007.

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

18CE C25

HYDROLOGY AND WATER RESOURCES ENGINEERING

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the students to understand
1. Surface & sub-surface hydrology, rainfall and measurement of rainfall.
2. Runoff, runoff estimation and surface reservoir planning.
3. Groundwater and its occurrence, theory of subsurface flow, flow to wells and yield, and irrigation practices.
4. Canal system, design theories, and canal outlets.
5. Design of Gravity dams, earth dams and seepage analysis, spillways and energy dissipators.

Course Outcomes: On completion of the course, students will be able to
1. analyse the components of hydrologic cycle and determine rain gauge network.
2. interpret various methods to estimate runoff and understand reservoir planning.
3. identify aquifer types , understand the process of sustainable groundwater management and evaluate the performance of irrigation system.
4. understand canal systems and design canals using regime concept.
5. analyse the stability of dams and understand spillways.

UNIT- I:
Introduction: Hydrologic cycle, water-budget equation, world water balance, hydrology applications in engineering, surface water resources of India.
Precipitation: Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area-duration relationships, depth-duration-frequency relationship, Probable Maximum Precipitation (PMP).Infiltration, infiltration capacity, infiltration indices, evaporation, and evapotranspiration.

UNIT- II:
Runoff: Runoff, factors affecting runoff, flow-duration curve, flow-mass curve, hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph.
Reservoirs: Types, selection of suitable site, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation and life of reservoir.

UNIT- III:
Ground water: Types of aquifers, Aquifer parameters, steady radial flow into a confined and unconfined aquifer, Darcy's law, yield of an open well, well hydraulics, Safe yield, Water harvesting structures and augmentation of ground water, Sustainable Ground Water management.
Irrigation: Duty, delta and base period of crops, crop water requirements, methods of applying water to the fields, micro irrigation, irrigation efficiencies, soil-water relationship, depth of irrigation, frequency of irrigation, wilting point, water logging, consumptive use.

UNIT- IV:
Distribution systems : Canal systems, alignment of canals, balancing depth, canal losses, estimation of design discharge. Design of canals- rigid boundary channels, alluvial channels- Kennedy's and Lacey's theory of regime channels. Lining of canals, types of lining.
Types of Canal outlets, Introduction to diversion head works and tion works.

UNIT- V:

Gravity dams: Types of dams, Forces on gravity dams, causes of failure, stress analysis, elementary and practical profile, and economical height of dam.

Earth dams: Classification, design considerations, control of seepage, slope protection.

Spillways: Types, components of spillways.

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, "Handbook of Applied Hydrology", McGraw-Hill Book Company, New York, 1964.

18CE C26

ESTIMATION, SPECIFICATIONS AND COSTING

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: To enable the students understand

1. The working of detailed estimates for different structures.
2. The working of steel quantities of R.C.C Framed works and preparation of BBS.
3. The rate Analysis for different items of works.
4. About TSDSS and Departmental procedures.
5. About Specifications and standard procedure for construction works.

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

1. prepare approximate estimates, detailed estimates for simple and complex buildings.
2. understand the RCC drawings and estimate the steel qualities to prepare BBS of various items of the buildings – beams, columns, slabs, footings and other civil engineering structures.
3. apply engineering knowledge to estimate quantities of roads, culverts, canals and septic tanks.
4. understand the work force required for the quantities estimated, as per TSSDSR and apply rate analysis to compute unit cost for different items of works of buildings, concrete and bituminous road works.
5. understand general and detailed specifications of works and record details of measurements in the M-Book and work force details in muster roll.

UNIT – I:

Introduction to Estimation, objectives of estimation, factors influencing estimation, types of estimates, detailed estimates for Flat roof buildings - load bearing and RCC framed using long wall and short wall method, centre line method.

UNIT – II:

Estimation of steel quantities and preparation of bar bending schedule (BBS) for RCC framed works - slabs (one way and two way), beams and columns, footings, stair case and retaining walls.

UNIT – III:

Detailed estimate of WBM roads, CC roads and Bituminous roads (including earth work), single cell rectangular box culvert, Septic tank and earth work of irrigation canals.

UNIT – IV:

Preparation of analysis of rates and theoretical requirements of materials as per Telangana State Standard Data and Schedule of Rates (TSSDSR) for major items of works of a building, all items of Bituminous and concrete road works.

UNIT – V:

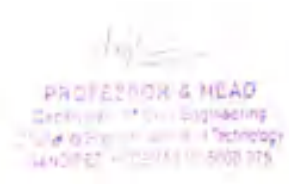
General and detailed specifications of various items of buildings and road works, M-Book and Muster Roll.

Text Books:

1. B. N. Dutta, "*Estimating and Costing in Civil Engineering – Theory and Practice*", UBS, publishers' distributors (p) ltd.-New Delhi 2012.
2. M.Chakraborti, "*Estimating, Costing, Specifications and Valu* Chakraborti 2006.

Suggested Reading:

1. Jagjit Singh, "*Estimating and Costing in Civil Engineering*", Galgotia Publications, New Delhi, 1996.
2. B. S. Patil," *Civil Engineering Contracts and Estimation*", Orient Black swan Private Ltd; Fourth edition 2015.
3. Telangana State Standard Schedule of Rates (TSSDSR).



18CE E18

DESIGN OF STEEL STRUCTURES - II

(Core Elective 5)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Codes required: IS 800 – 2007, steel tables, Bridge rules, Bridge Code (RDSO), IS: 875 Part-2 & Part-3

Course Objectives: To enable the students

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 &rollerbearings and is able to interpret the specifications of relevant codes.
3. Acquire adequate conceptual knowledge and skills to extend the sameto investigate into critical issues , compare various options &choosebest solution for the problems in the areas of highway , industrial andrailway steel structures
4. Consider economy in the design of these structures without sufferingthe 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. understand the phenomenon of shear buckling in beams with larger depths, design and detail welded plate girder for various structural actions.
2. estimate the loads on gantry girders, design and detail gantry girder including connections.
3. identify suitable bridge type, design roller & rocker bearings for railway bridges.
4. develop the layout of the bridge, design and detail deck type riveted plate girder bridge including wind effects.
5. choose the appropriate truss configuration, develop layout of the bridge, and design & detail truss girder bridges.

UNIT- I:

Design of 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, Loads, Codal provisions, Detailed Design- Cross section and connections, Drawing- general layout and cross section;

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.

Bearings: Types and general description of various bearings, detailed 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- Detailing; General layout, longitudinal and cross sections

UNIT- V:

Design of Through type riveted truss girder railway bridges: Truss configurations, Detailed design of stringer beams, Cross girders and Truss girders; Wind effects- Design of top lateral and bottom lateral bracing, Portal and sway bracings; Drawing-General layout , generation of longitudi

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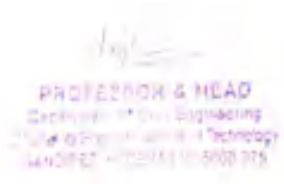
Text Books:

1. S. K. Duggal, “Limit State Design of Steel Structures”, 3rd Edition, McGraw Hill HED, 2019.
2. B.C. Punmia and Ashok Kumar Jain, “Comprehensive Design of Steel Structures”, Laxmi Publications, 2015.

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 VirendraGehlot, “Design of Steel Structures”,Volume – 2, Scientific Publishers, 2008.



18CE E19

AIRPORT ENGINEERING
(Core Elective –5)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: to enable the student

1. know the components of airports
2. know the factors effecting different airport component
3. know the site selection for airports
4. understand the design standards applicable in airport engineering
5. get an idea about air traffic management

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

1. understand the structure of airport system.
2. understand the components of aircraft and airport.
3. apply engineering knowledge for selection of airport sites, plan airports and facilities as per international standards and also understand the corrections to be applied for runway.
4. design airports as per ICAO standards and develop the facilities required for passengers and aircrafts.
5. create the facilities required for the airport traffic management and understand the importance of the drainage system and its design in airports.

UNIT- I:

Introduction of Air Transport System: History of air transportation, roles and responsibilities of director of Civil Aviation and National Airport Authority, International Airport Authority of India, Airports Authority of India, ICAO, growth of air transport.

UNIT- II:

Aircraft Characteristics:

General introduction, relationship between aircraft and airport, effects of aircrafts on airports, aircraft characteristics, components of an aircraft.

UNIT- III:

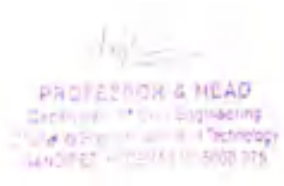
Airport Planning: Airport master plan**-** FAA and ICAO recommendations, regional planning, airport site selection, airport location, typical layout of a terminal areas and airport incorporating airport components- terminal building, apron, hangar, Runway design- runway orientation, wind rose diagrams, basic runway length, connections to runway lengths, airport classifications and airport obstructions.

UNIT- IV:

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, exit taxiways.

UNIT- V:

Air Traffic Management: Visual aids**-**airport marking, airport lighting, air traffic control– need of air traffic control, concepts of air traffic control network, air communication, air traffic control aids, ILS and installations, landing aids, airport drainage system– special requirements of airport drainage system, design procedures for surface and sub– surface drainage systems.



Text Books:

1. Khanna. S. K. Arora, M. G. and Jain. S. S, "*Airport Planning and Design*" Fifth edition. Nem Chand & Bros, Roorkee, India, 1999.
2. K. P. Subramanian," *A text book on Highway, Railway, Airport and Harbour Engineering*", Scitech Publications (India) Pvt. Ltd., 2015.

Suggested Reading:

1. Subash C Saxena, " *Airport Engineering Planning and design*", CBS 1st edition, 2010.
2. Norman J.Ashford, Saleh A. Mumayiz and Paul H. Wright "*Airport Engineering Planning - Design and development and Planning- 21st century airports*", Wiley India Pvt. Ltd, 2012.
3. R. Srinivasa Kumar, "*Airport, Railway, Dock and Harbors*", Universities Press, 2014

18CE E20

RIVER ENGINEERING
(Core Elective-5)

Instruction	3 Hours perweek
DurationofSemesterEndExamination	3Hours
SemesterEndExamination	70Marks
CIE	30Marks
Credits	3

Course Objectives: To enable the students to understand

1. The concepts of rivermorphology
2. The methods of stage measurement.
3. Hydraulicriver models.
4. Riverprotectionandtrainingworks
5. Designflood protection structures

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

1. define basic terms and understand the concepts of rivermorphology.
2. determine scour depth of hydraulic structure and identify methods of stage measurement.
3. understand hydraulic river models.
4. identify river training works and understand protective measures.
5. designflood protection structures.

UNIT- I:

Rivermorphology: Behaviourofriverflow,roleofsedimentsinrivers,changes in regimes. Sediment transport mechanics - bed forms, bed load transport, and transport of suspended sediment, critical shear stress, and sediment transport equations.

UNIT-II:

AggradationandDegradation: Localscouratbridgepiersandotherhydraulic structures, measurements in rivers - stage measurements, channel geometry, discharge, and sediment samplers and suspended and bed loadmeasurement.

UNIT-III:

Hydraulicmodellingofrivers: Hydraulicsimilitude,physicalrivermodels-fixed and movable bed models; sectional models, distorted models, mathematical models for aggradations, degradation and localscour.

UNIT- IV:

River Protection and Training Works: Introduction, classification of river training,typesoftrainingworks,protectionforrevetments,dikes,gabions,spurs, bank protective measures and bed controlstructures.

UNIT- V:

Design of river flood protection structures: Diversion and cofferdam, river regulations systems, dredging and disposal, river restoration.

Text Books:

1. P.Y.Julien,"*RiverMechanics*",CambridgeUniversityPress,March 2018
2. S.K.Garg,"*IrrigationEngineeringandHydraulicStructures",* Khanna Publishers, 2017

Suggested Reading:

1. R.J. Gardeand K.G. RangaRaju, "*Mechanics of sediment transportationandAlluvialstreamproblems"*,WileyEasternlimited, 1977
2. Central Board OfIrrigation /er, "*River BehaviourManagementandTraining(Vol.I&II)",*Nev

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3. U.S.ArmyCorpsofEngineers,"*RiverHydraulics*",UniversityPress ofthePacific,2004.

18CE E21

WATER AND AIR QUALITY MODELING
(Core Elective –5)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student
1. Understand various systems, models and their development.
2. Learn about the river water quality modelling and Benthal Oxygen Demand of sediments.
3. Get educated on the models for lakes and estuaries & transport mechanisms.
4. Learn about plume characteristics, air pollution modelling and its applications.
5. Understand plume behaviour using Gaussian plume equation for different atmospheric stability conditions.

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

1. develop and validate mathematical models for stream water quality and perform cost benefit analysis.
2. assess water quality of rivers using models such as Streeter Phelps model and determine oxygenation coefficients, oxygen consumption by the sediments in rivers.
3. develop models for estuaries for their continuous quality monitoring and understand transport mechanisms.
4. apply knowledge of plume characteristics and diffusion of stack emissions in modelling.
5. derive models for air quality monitoring, Gaussian plume equation and compute stack height.

UNIT -I:
Introduction to Mathematical Models: Role of mathematical models; systems approach, systems and models, kinds of mathematical models, model development and validation effluent and stream standards; water quality model development, cost: benefit analysis using models, model requirements and limitations; Dissolved Oxygen model for streams sources and sinks of dissolved oxygen.

UNIT -II:
Surface Water Quality Modelling: Historical development of water quality models; rivers and streams water quality modelling, Streeter Phelps model, oxygen sag curve, determination of deoxygenation and re-aeration coefficient, Benthal oxygen demand.

UNIT -III:
Mass transport mechanisms: Models for Estuary and Lakes: Physical chemical and biological processes in estuaries; estuarine transport, net estuarine flow, estuary dispersion coefficient; Lakes and impoundments: Water quality response to inputs; water quality modelling process.

UNIT - IV:
Air pollution Modelling: Chemistry of air Pollutants, atmospheric reactions, sinks for air pollution, transport of air pollutants, meteorological settling for dispersal of air pollutants, vertical structure of temperature and stability, self cleaning of atmosphere, transport and diffusion of stack emissions, atmospheric characteristics significant to transport and diffusion of stack emission, stack plume characteristics.

UNIT - V:
Air quality models: Types of modelling techniques, multiple sources and area sources, fixed box models, Diffusion models, Gaussian plume derivation, modifications of Gaussian plume equation, stack height computation.

Text books:

1. Steven C. Chapra," *Surface Water Quality Modelling*", Tata McGraw Hill New York, 1997.
2. Alex De Visscher, "*Air dispersion modelling: Foundations and applications*", Wiley-Blackwell Publications, Nov 2013.
3. AbhishekTiwary, Ian Williams, "*Air Pollution: Measurement, Modelling and Mitigation*", CRC Press; 4 edition, 2018.

Suggested Readings:

1. R.W. Boubel, D.L. Fox, D.B. Turner & A.C. Stern, "*Fundamentals of Air Pollution*", Academic Press, New York, 2006.
2. P. Zannetti, "*Air pollution modelling*", WIT, Software edition 1990.

18CE E22

APPLICATION OF DATA ANALYTICS IN CIVIL ENGINEERING
(Core Elective –5)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The main objectives of this course are:

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. 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 modeling 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

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 roblems.

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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 - 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. MashrurChowdary, Amy Apon and KakanDey, Data Analytics for Intelligent Transportation Systems, 2012
2. SubhashishSamaddar and SatishNargundkar,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.
3. http://nptel.ac.in/courses/106106126/

18CE C27

CONCRETE TECHNOLOGY LAB

Instruction		3P Hours per week
Duration of Semester End Examination		3 Hours
Semester End Examination		50 Marks
CIE		25 Marks
Credits	1.5	

Course Objectives:

1. Conduct tests on cement
2. Conduct tests on Fine Aggregate and Coarse Aggregate
3. Conduct 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. determine the properties of fine and coarse aggregate samples to assess their suitability for use in construction 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.

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 coarse Aggregate
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. Demo on Non-destructive testing of concrete specimen

Referencebooks:

1. M.S. Shetty, “Concrete Technology- Theory & Practice”, S. Chand & Company Publishers.
2. IS 10262:2019,”Indian Standard Concrete Mix Proportioning – Guidelines”.

18CE C28

COMPUTER APPLICATIONS LAB

Instruction	3 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: Enable the students

1. Explore a few software packages used in various areas of Civil Engineering (Structural Analysis & Design, Soil Mechanics, Water Supply & Sanitary Engineering, and Surveying) and the applications of different software packages.
2. Attain the fundamental knowledge of navigation of software packages.
3. Acquire adequate conceptual knowledge and skills to use software packages in the field in order to provide solutions to civil engineering problems.
4. Provide accelerated/time bound solutions with help of software packages without effecting the accuracy of computations.
5. Understand the rectification of errors while using software packages.

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

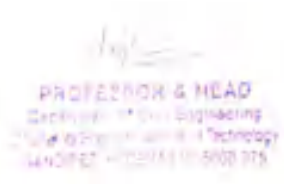
1. develop a model of framed structure and analyze using STAAD-Pro.
2. design the components of a framed structure including isolated footings using STAAD-Pro and STAAD Foundation.
3. evaluate stability of slope using Slip Circle method and design a cantilever retaining wall using GEO5.
4. analyze pipe networks using EPANET and sewer networks using SEWER Gems.
5. develop geo-referenced thematic maps and carry out overlay analysis using ArcGIS/QGIS

List of Exercises:

1. Modelling and analysis of plane frames using STAAD-Pro.
2. Modelling and analysis of space frames using STAAD-Pro.
3. Design structural components of a RC building using STAAD-Pro.
4. Design of isolated footing using STAAD Foundation.
5. Analysis of a slope for stability by Slip Circle method using GEO5 (Slope Stability module).
6. Design of cantilever retaining wall using GEO5 (Cantilever Wall module).
7. Steady state analysis of pipe networks (open/looped) using EPANET.
8. Analysis of sewer networks using SEWER Gems.
9. Digitization of topo-sheets and perform overlay analysis using ArcGIS.

Textbooks/References:-

1. STAAD.Pro V8i (SELECTseries 4) manual on staad exercises, July 2019.
2. EPANET 2 Users Manual Paperback – Import, 30 January 2013 by U S Environmental Protection Agency (Creator)
3. Instructional Guide for The ArcGIS Book 1st Edition, Kindle Edition by Kathryn Keranen (Author), Lyn Malone (Author), Esri Press; 1 edition (June 21, 2016)
4. Design of Sewer Network Using SewerGEMS Software Paperback – September 17, 2018 by HinalSopariya (Author)
5. https://www.finesoftware.eu/engineering-manuals/ for GEO5 execises.



18CE C29

PROJECT: PART-1

Instruction	Hours per week
Continuous Internal Evaluation	50 Marks
Credits	2

The objective of Project Part -1 is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

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 the domain of one's interest through critical review of literature.
2. define a problem in the domain of interest and understand its scope and also develop the skill of coordinating with the team in the form of discussions during the progress of finding the solution.
3. examine various approaches and build a preliminary approach to the problem on chosen topic.
4. defend their approach by healthy interactions with the participants and modify, if necessary and cultivate the culture of ethical practices.
5. develop the technical skill in preparing a well structured report and present.

Guidelines for the award of Marks:

Maximum Marks: 50

Evaluation by	Maximum Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Departmental Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

PROFESSOR & HEAD

18CE E23

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES
(Core Elective-6)

Instruction	3L Hours per week		
Duration of Semester End Examination	3 Hours	Semester End Examination	70 Marks
CIE	30 Marks	Credits	3

Course objectives: To enable the student

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 thesevibrations , 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 structures. Evaluate the seismic loads on the structures using IS 1893 Part I codal provisions.
4. Gain knowledge of Seismic Performance of Engineered and NonEngineered 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. relate the fundamentals of engineering seismology, understand the characteristics and effects of strong motion earthquakes.
2. understand 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. know the use of various earthquake resistant devices, apply suitable construction techniques for retrofitting.

UNIT – I:

Engineering Seismology& Elements : Causes of Earthquakes–Geological faults,Tectonic Plate theory – Elastic Rebound theory –Focus - Epicentre – 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:

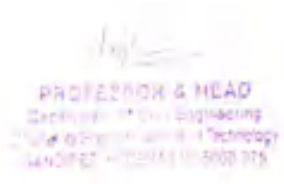
Theory of Vibrations: Introduction to Vibrating Systems – mass, stiffness and damping parameters – Concept of inertia, elastic restoring force and damping –types of damping, difference between static forces and dynamic excitation.

Single Degree of Freedom (SDOF) Systems – SDOF idealization - Formulation of Equation of motion(for mass as well as base excitation) and response for free, forced (harmonic loads only), damped &undamped vibrations, Logarithmic Decrement & Influence of gravitational force on the equation of motion, Natural Time period & Natural Frequency.

Multi Degree of Freedom (MDOF) Systems - Equation of Motion–Mass, stiffness and damping matrices, Modal Analysis -Natural frequencies - generation of modal frequencies and mode shapes, Concept of Response Spectrum – Response Spectrum Curve as per IS: 1893 Part I (2016).

UNIT – III:

Evaluation of Seismic Loads on Structures: Concepts of over ndancy –Determination of earthquake forces on structures – Seismic Co-efficient and Re



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, Design Provisions as per IS – 1893(2016), 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: Repair, rehabilitation and retrofitting, retrofitting strategies – Importance of Re-analysis, Retrofitting Techniques for RCC, Masonry and rural buildings, IS – 13935(2009) codal provisions for Retrofitting.

Text Books:

1. PankajAgarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India 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 Chandrasekaran, Brijesh Chandra, "Elements of Earthquake Engineering", South Asian Publishers Pvt. Ltd, Second Edition,2014.
3. Steven L Kramer, "Geo-Technical Earthquake Engineering", Pearson Education Ltd, 2013.

PROFESSOR & HEAD

18CE E24

GROUND IMPROVEMENT TECHNIQUES
(Core Elective-6)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students able to
1. Understand the importance of ground improvement and learn about various types of ground improvement techniques suitable for given soil conditions.
2. Understand the concepts behind a range of ground improvement and soil remediation techniques by using chemical stabilization and grouting methods.
3. Understand the different concepts of vibration techniques for cohesionless soils stabilization.
4. Select suitable stabilization method for cohesive soils.
5. Understand the Types, functions and applications of Geo-textiles, geo-grid, tests on geo-textiles and Reinforced earth.

Course Outcomes: At the end of the course, the student will be able to
1. review the importance of ground improvement techniques and types, for different soils.
2. apply suitable chemical stabilization and grouting techniques to address the field problems.
3. modify the cohesionless soil properties to required degree by using suitable vibration techniques.
4. identify suitable ground improvement techniques for cohesive soils in a specific project.
5. explain different advanced stabilizing techniques for slopes.

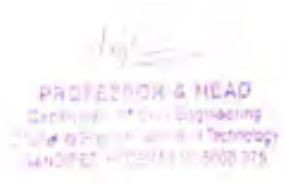
UNIT- I:
Introduction: Need for ground improvement, applications, and factors affecting – different mechanical, chemical, static and dynamic techniques – mechanical stabilization – blending of aggregate – Rothfutch Testing. Concept of Soil confinement, Gabion Walls, Crib Walls and Sand Bags.

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:
Stabilization 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:
Stabilization of Cohesive soils: Expansive Soils- parameters of expansive soils and their classification- moisture changes in expansive soils- CNS technique. 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 - design methods and construction techniques.
Geo-textiles: Woven and non-woven fabrics. Types, functions and applications– Geo-textiles, geo-grids, tests on geo-textiles, Reinforced earth – Principles and factors governing design.

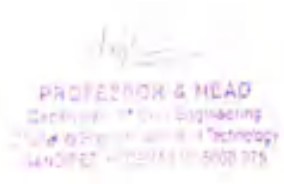


Text Books:

1. P. Purushothama Raj, “Ground Improvement Techniques”, Laxmi publications 2016.
2. K.R Arora, “Soil Mechanics and Foundation Engineering”, 5th Edition, Standard Publishers, 2005.

Suggested Reading:

1. NiharRanjanPatra, “Ground Improvement Techniques”, Vikas publishing house Pvt. Ltd, 2012.
2. R. Hausmann., “Engineering Principles of Ground Modification”, McGraw Hill Publishing Co.,2013.
3. H. Fang,” Foundation Engineering Hand Book”, 2nd Edition, CBS Publication, New Delhi, 2004.
4. G. V. Rao and G. V. S. S. Raju, “Engineering with Geosynthetics”, McGraw Hill Education, 1998 5. IRC-SP 58 (2001): “Guidelines for use of fly ash in road embankments”.



18CE E25

DESIGN OF HYDRAULIC STRUCTURES
(Core Elective-6)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The student should be able to understand
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. analyse and design surplus weir.
2. analyse and design direct sluice.
3. identify types of falls and design glacis type canal drop.
4. understand and design cross regulator.
5. identify types of spillways and design energy dissipators.

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 main canal and distributary, general arrangements of various components- Design of vent way, Sluice barrel, Head walls, Wing Walls and return walls.

UNIT- III:
Canal Falls: Definition, types of falls.
Glacis type Canal Drop: Design of 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 and cistern type.

Text Books:
1.B.C. Punmia, "Irrigation & Water Power Engineering", Lakshmi Publications, Delhi, 2016.
2. Ch. S. N. Murthy, "Water Resources Engineering: Principles and Practice", New Age International Publishers, Delhi, 2002.

Suggested Reading:
1. R S Varshney, S C Gupta, R L Gupta, "Theory & Design of Irrigation Structures Vol. 1", Nem Chand & Brothers, 1992.
2. S. K. Garg, "Irrigation Engineering and Hydraulic Structures" elhi, 2017.
3.Sharma, S. K. Irrigation Engineering and Hydraulic Structures

PROFESSOR & HEAD

18CE E26

RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEM
(Core Elective-6)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To enable the student
1. Identify the problems pertaining to rural water supply and sanitation.
2. Be conversant about water treatment and sanitation system for rural community.
3. Understand wastewater treatment collection and treatment units in rural areas.
4. Get educated on Industrial hygiene, sanitation and occupational hazards.
5. 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. solve the issues related to rural water supply and sanitation.
2. relate the needs for water treatment and develop 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 and hygiene system and identify occupational hazards.
5. design an effluent disposal mechanism; develop solid waste management system in rural areas.

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, 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 in schools, public buildings and hospitals; Industrial plant sanitation.

UNIT- V:
Septic tanks: Design of septic tanks, single pit and double pit toilets, small bore systems, bio digesters, reed beds, constructed wetlands, sludge/seepage management systems, stabilization ponds; Solid Waste Management: Biogas plants, rural health, other specific issues and problems encountered in rural sanitation.

Text Books:
1. V. M. Eulersand E. W. Steel, "*Municipal and Rural Sanitation*", 6th Ed., McGraw Hill Book Company, 1965
2. F. B. Wright, "*Rural Water Supply and Sanitation*", 3rd Revised edition, McGraw-Hill Inc ,US, 1977
3. P. Juti, S. K.Tapio, and H. Vuorinen, "*Environmental History ommunity Water Supply and Sanitation*", IWA Publishing (Intl Water Assoc), 200

PROFESSOR & HEAD

Suggested Reading:

1. Manual of water supply and treatment, 3rd edition, CPHEEO, GOI, New Delhi.
2. A handbook on "*Technological Options for On-site sanitation in rural areas",* Ministry of Drinking water & Sanitation, Govt. of India, June 2016
3. A Guide to the Development of on-site sanitation, WHO, 1992

18CEE27

APPLICATIONS OF BLOCKCHAIN TECHNOLOGY IN CIVIL ENGINEERING
(Core Elective-6)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To get the terminologies and overview of Blockchain technology
2. To study the concepts and foundation of Blockchain technology
3. To understand the applications of Blockchain technology in civil engineering
4. To design use cases and architecture Blockchain technology
5. To study benefits, limitations and identify application area of Blockchain technology

Course outcomes: at the end of course, students would be able to:

1. Gain a clear understanding of the concepts that underlie Blockchain and Blockchain and types of Blockchain.
2. Understand key mechanisms like decentralization, transparency and trust, immutability.
3. Understand the importance of Blockchain in construction industry apply the concepts of smart contracts using Blockchain technology.
4. Understand and apply the project management systems using Blockchain technology.
5. Apply the concepts of building information modelling using Blockchain technology.

UNIT 1:Introduction to Blockchain: Introduction to centralized, decentralized and distributed system, History of Blockchain, Various technical definitions of Blockchain. **Generic elements of a blochchain:** Block, Transaction, Peer to peer network, Node, Smart contract, Why it's called blckchain. **Types of Blockchain:** Public Blockchains, Private Blockchains, Semi-private Blockchains, Sidechains, Permissioned ledger, Distributed ledger, shared ledger, Fully private and proprietary Blockchains, Tokenized Blockchains, Token less Blockchains, CAP theorem and Blockchain.

UNIT II: Concepts of Blockchain Technology: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, and Structure of Blockchain. Applications of Blockchain technology, Tiers of Blockchain technology: Blockchain 0, Blockchain 1, Blockchain 2, Blockchain 3, generation of Blockchain X.

UNIT III:Applications of Blockchain technology in Civil Engineering: Importance of Blockchain in construction industry. Blockchain in operation, public and Private Blockchain types, Smart contracts on the Blockchain to enhance efficiency, Ideal solution for the construction industry.

UNIT IV:Payment and Project Management: Blockchain enabled project collaboration, Transparency in construction industry, Procurement and Supply Chain Management, Sustainable procurement in the construction industry enabled by Blockchain, Fostering enhanced and trust in the supply chain

PROFESSOR & HEAD

UNIT V:Building Information Modelling (BIM) – BIM and Blockchain. Project delivery 'designed' to 'as built'.Smart Asset Management through BIM.Challenges and Implementation – Stages of Blockchain implementation in the industry.

Crypto currency: Bitcoin, Bitcoin definition, keys and addresses, public keys in Bitcoin, private keys in Bitcoin, Bitcoin currency units.

Textbooks:

1. Imran Bashir, "Mastering Blockchain", Packt Publishing Limited, 2nd edition 2018.
2. Narayan Prusty, "Building Blockchain Projects", Packt Publishing, 1st edition 2017.

References:

1. Blockchain For dummies, IBM Limited Edition, John Wiley & Sons, Inc.
2. Lemes, Samir, and LamijaLemes. Blockchain in Distributed CAD Environments". In International Conference "*New Technologies Development and Applications*", pp. 25-32. Springer, Cham, 2019.
3. Blockchain Technology in the Construction Industry-Digital Transformation for High Productivity, 2018.

18CE C30

TECHNICAL SEMINAR

Instruction	2 Hours per week
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 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 Civil Engineering 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.

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:

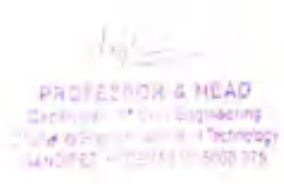
1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the 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 shall be 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



18CE C31

PROJECT: PART-2

Instruction	10 Hours per week
Continuous Internal Evaluation	100 Marks
Semester End Examination	100 Marks
Credits	10

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 studies to facilitate continuous learning.
4. Develop the art of technical report writing by following ethical practices.
5. Defend the work through a well structured presentation.

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 student(s) 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/Modeling/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)

Evaluation by	Maximum Marks	Evaluation Criteria / Parameter
Department Review Committee	10	Review 1
	15	Review 2
	25	Submission
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	Analytical/ Programming/ Experimental Skills

PROFESSOR & HEAD

Guidelines for awarding marks in Semester End Examination: (Maximum 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

PROFESSOR & HEAD

20CE C101

STRUCTURAL DYNAMICS

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

Course Objectives: To enable the student

1. To make the student understand the importance of structural dynamics and appreciate its practical applications.
2. To make the student learn the process of formulation of equations of motion and generate their solutions.
3. To make the student well versed with modal analysis and make him to develop the response by mode superposition.
4. To make him learn the methods of practical vibration analysis and also generate response considering the system as continuous systems.
5. To make him conversant with the numerical solutions to find the response of dynamic systems.

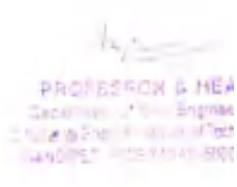
Course Outcomes: At the end of the course, student is able to

1. The student gains expertise and confidence to tackle field dynamic problems, especially in the field of earthquake and wind engineering. 2. Gets the ability to model any dynamic system and get its response.
3. Can carry out modal analysis and can easily handle any software and can correctly interpret the results.
4. Can effectively use practical vibration analysis methods and obtain the dynamic parameters.
5. Gets the ability to apply numerical methods to get the dynamic response of the systems.

UNIT - I:

Introduction to structural Dynamics – Source of dynamic forces – Rotating machinery, wind and seismic forces, blast loads. **Methods of discretization**: Lumped mass Procedure and Consistent mass procedure.

Single Degree Freedom Systems – Formulation of Equation of D'Alemberts's Principle, Method of Virtual Work, Hamilton's Princi



Generalized SDOF systems and Rigid Body assemblage. Influence of Gravity Forces and Ground Motion on equation of motion.

UNIT - II:

Single Degree of Freedom System: Response to Free Vibration with and without Damping, Logarithmic decrement. Response to Harmonic loading and impulsive loading. Dynamic magnification factor, phase angle and band width. Response to General Dynamic loading using Duhamel's Integral - Fourier analysis for Periodic Loading.

UNIT - III:

Multiple Degree of Freedom System: Evaluation of structural property matrices – Formulation of MDOF equations of motion – Undamped free vibration – Solution of Eigen value problem for natural frequencies and mode shapesAnalysis of dynamic response- Normal coordinates – Orthogonal properties of normal modes -Uncoupled equations of motion –- Mode super position procedure.

UNIT - IV:

Practical Vibration Analysis: Stodola Method - Fundamental mode analysis, Analysis for second and higher modes. Holtzer Method – basic procedure. **Continuous Systems:** Flexural vibrations of beams- Elementary case - Derivation of governing differential equation of motion - Analysis of undamped free vibration of beams in flexure – Natural frequencies and mode shapes of simple beams with different end conditions.

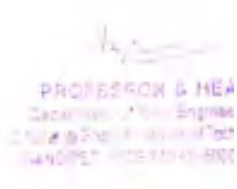
UNIT - V:

Numerical Evaluation of Dynamic Response of linear (SDOF/MDOF) systems: Time stepping methods, Central difference method, Newmarks method and Wilson method.

References:

1. Anil. K. Chopra," *Dynamics of Structures",* Pearson Education India, 2007.
2. Ray W. Clough, Joseph Penzin," *Dynamics of Structures*", CBS Publishing, 2015.
3. Mario Paz,"*Structural Dynamics: Theory And Computation*", CBS Publishing, 2004.

4. PankajAgarwal and Manish Shrikhande*," Earthquake Resistant Design of Structures"*, PHI, 2006.
5. Biggs," *Introduction to Structural Dynamics*", Mc Graw Hill Education, 2013.



20CE C102

FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

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

Course Objectives: To enable the student

1. Learn the fundamentals of Finite element method (FEM) and derive elasticity matrices for 2-D and 3-D elasticity problems.
2. Understand basic principles of minimum potential energy methods and variational formulation of FEM know the stiffness matrix formulations using bar element and analyze simple problems.
3. Understand the FEM formulation using truss, beam, and plane frame elements and analyze simple problems with kinematic indeterminacy not greater than 3.
4. Get familiarized with displacement models, Isoparametric elements and quadrilateral elements and know the formulation of global stiffness matrices.
5. Know the formulation of stiffness matrices for Axi-Symmetric elements, Tetrahedron elements.

Course Outcomes: At the end of the course, student is able to 1. The fundamentals of FEM, elements of theory of elasticity.

2. Principle of minimum potential energy and variation formulation of FEM and analyze simple problems using bar elements.
3. The analysis of trusses beams and rigid jointed plane frames.
4. The formulation of Global stiffness matrix, load matrix and analysis structures using 1st order triangular elements, isoparametric elements, and quadrilateral elements.
5. Application of Axi-Symmetric and Tetra-Hedron elements.

UNIT - I:

Introduction to FEM: General description of the method, brief history of the method, applications of the method, advantages of the finite element

steps in the finite element method. Types of elements; Types of forces, and Boundary conditions.

Strain displacement, and stress- strain relations for 2-D and 3-D problems. Equations of equilibrium and compatibility conditions for 2-D and 3-D problems. Plane stress and plane strain situations and derivation of elasticity matrices (D).

UNIT - II:

Finite Element Formulation: Principle of minimum potential energy, Principle of virtual displacement, Global coordinate system, local coordinate system, Raleigh Ritz method, Weighted Residual method- Galerkin's method, Boundary value problems- with one element and two elements.

Bar Elements: Shape functions, stiffness matrix for a 2- noded bar element, axial bar subjected to point loads-constant cross section and varying cross section bar.

UNIT - III:

Truss Elements: Transformation matrix, Stiffness matrix of truss member in local and global axis, analysis of trusses with kinematic indeterminacy not exceeding three.

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 - IV:

Displacement models: Selection of displacement models, geometric invariance, conforming and non-conforming elements.

2-D 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. Problems with kinematic indeterminacy not exceeding three.

Iso-parametric elements: Iso-parametric concept, Iso-parametric, Sub parametric and Super parametric elements. Gauss Quadrature of numerical integration. **Quadrilateral elements**: Construction of shape functions for 4 noded and 8 noded elements, determination of stiffness matrix, and nc matrices for 4noded quadrilateral element.

PROFESSOR & HEA

UNIT - V:

Axi-symmetric elements: Strain-displacement relationship, stress-strain relationship, determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction.

Tetrahedron elements: Volume coordinates, Strain-displacement matrix, and stiffness matrix.

Computer Implementation of FEM procedure, Pre-Processing, Post-Processing.

Use of Commercial FEA software.

References:

1. David V. Hutton," *Fundamentals of Finite Element Analysis*", McGraw Hill Education (India) Private Limited, Delhi, 2014.
2. P. N. Godbole," *Introduction to Finite Element Method"*, I. K. International Publishing House Pvt. Ltd. New Delhi, 2013.
3. P. Seshu, "*Finite Element Analysis*", Prentice Hall of India Private Limited, New Delhi, 2010.
4. T. R. Chandrupatla and A. D. Belegundu," *Introduction to Finite Elements in Engineering*", Prentice –Hall of India Private Limited, New Delhi, 2009.
5. Daryl L, Logan, "*A first course in the Finite Element Method*", Third Edition, Thomson Brook, Canada Limited, 2007.
6. R. D. Cook, R.D" *Concepts and Applications of Finite Element Analysis*", John Wiley and sons, 1981.
7. O. C. Zienkiewicz. And R. L. Taylor, "*The Finite Element Method*", Vol.1, McGraw Hill Company Limited, London, 1989.

20CE E102

ADVANCED STRUCTURAL ANALYSIS
(ELECTIVE-I)

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

Course Objectives: To enable the student

1. Gain knowledge of using matrix methods of structural analysis stiffness and flexibility methods to analyse beams and trusses
2. Learns the basic concepts of analyse of frames and grids using flexibility methods.
3. Learns the basic concepts of analysis frames and slides using stiffness method
4. Understand the concepts of beams on elastic foundations with semi infinite and infinite lengths
5. Grasps the fundamentals of solving boundary value problems using approximate methods

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

1. Analyse continuous beams and redundant trusses using force and displacement approaches (flexibility & stiffness approaches) of matrix methods
2. Analyse rigid jointed plane frames and grids by flexibility methods.
3. analyse rigid jointed plane frames and grids by stiffness methods.
4. Applies the concepts of (beams of semi-infinite and infinite lengths) an elastic foundation to field problems and analytical models.
5. Solve the boundary value problems using approximate methods.

UNIT- I:

Introduction to matrix methods of structural analysis: Static and kinematic indeterminacies, Matrix formulations by force and displacement r

Analysis of continuous beams and redundant trusses by force and displacement methods with degree redundancy and freedom not exceeding three.

UNIT- II:

Analysis of rigid jointed plane frames and grids: by Flexibility approach with degree of redundancy not exceeding three**.**

UNIT- III:

Analysis of rigid jointed plane frames and grids: by Stiffness approach with degree of freedom not exceeding three.

UNIT- IV:

Beams on elastic foundation: Introduction - Modulus of foundation and basic equation - Beams of infinite length under concentrated and uniformly distributed loads - Analysis of semi-infinite beams making use of functions for infinite beams.

UNIT- V:

Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

References:

1. William Weaver and James M. Gere, "*Matrix Analysis Framed Structures* ", CBS, 2004.
2. Devadas Menon," *Advanced Structural Analysis*", Narosa, 2009.
3. A. K. Jain, "*Advanced Structural Analysis*", Nem Chand & Bros. 2015.
4. R. C. Hibbler," *Structural Analysis*", Pearson, 2015.
5. P. Seshu," *Text Book of Finite Element Analysis*", PHI, 2003.

20CE E104

STRUCTURAL HEALTH MONITORING (ELECTIVE-II)

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

Course Objectives: To enable the student to understand the fundamental concepts of

1. Distress in the structure.
2. Assess the health of structure. Audit for structural health monitoring
3. Static and dynamic field tests.
4. Repairs, strategies for repairs and rehabilitation methods of the structure
5. Piezo–electric materials and other smart materials,

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

1. Appraise importance of Diagnosis the distress in the structure, develop an understanding the root causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Identify the locations for repairs and various repair methods, can able to suggest rehabilitation methods for structure
5. Adapt and implement EMI technique

UNIT- I:

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

UNIT- II:

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT- III:

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT- IV:

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT –V:

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

References:

1. Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes," *Structural Health Monitoring*", John Wiley and Sons, 2006.
2. Douglas E Adams,"*Health Monitoring of Structural Materials and Component Methods with Applications*", John Wiley and Sons, 2007.
3. J. P. Ou, H. Li and Z. D. Duan,"*Structural Health Monitoring and Intelligent Infrastructure, Vol1"*, Taylor and Francis Group, London, UK, 2006.
4. Victor Giurglutiu," *Structural Health Monitoring with Wafer Active Sensors*", Academic Press Inc, 2007.

20ME M103

RESEARCH METHODOLOGY AND IPR

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

Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

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

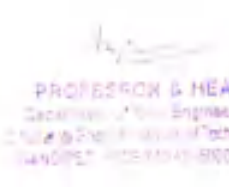
1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT – I:

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT – II:

Literature Survey Report writing: Literature Survey: Importa purpose of Literature Survey, Sources of Information, Assessment of



of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing a report. Research Proposal Preparation: Writing a Research Proposal and
Research Report, Writing Research Grant Proposal

UNIT – III:

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT – IV:

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

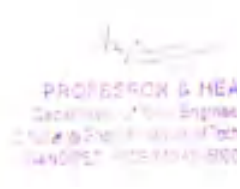
UNIT – V:

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright, What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

References:

1. C.R Kothari, "*Research Methodology, Methods & Technique*"; New Age International Publishers, 2004
2. R. Ganesan, "*Research Methodology for Engineers*", MJP Publishers, 2011
3. Y.P. Agarwal, "*Statistical Methods: Concepts, Application and Computation*", Sterling Publs., Pvt., Ltd., New Delhi, 2004.
4. AjitParulekar and Sarita D' Souza, "*Indian Patents Law – Legal & Business Implications*"; Macmillan India ltd , 2006
5. B. L.Wadehra; "*Law Relating to Patents, Trade Marks, Copyright Designs & Geographical Indications*"; Universal law Pu Pvt. Ltd., India 2000.

6. P. Narayanan; *"Law of Copyright and Industrial Designs*"; Eastern law House, Delhi 2010



20CE C103

STRUCTURAL DESIGN LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: **Course Objectives: To enable the student**

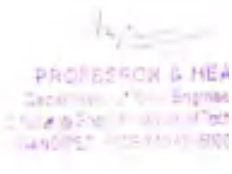
1. Learn the principles of idealization of beam grids and frames for the given plan of a building
2. Know the methods of calculating loads on the building elements
3. Grasp the concepts of Analysis of building frames manually & also using software elements
4. Understand the concepts of design of building elements with a practical approach, and also concepts of grouping the designs.
5. Learn the professional practices of preparing structural drawings with good detailing.

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

1. Idealize beam grids and frames for the given plan of a building
2. Calculate loads on building elements for a given plan
3. Analyse building frames using a manual method and software
4. Design all structural elements of a given building with a practical approach and grouping the design.
5. Prepare structural drawings with good detailing, in a professional way.

Design Project:

Design and Detailed drawing of complete G+ 3 structures: Idealization of beam grid and frames for a given plan – Load calculations and preliminary design – Analysis of frames using software, manual check for atleast one frame – Design of building elements using software – grouping of members – design of typical elements (manually) - detailing of reinforcement for various groups of elements – preparation of structural drawings – introduction to processional practices in drawing.



References:

1. V. L. Shah and V. R. Karve, "*Illustrated Design of Reinforced Concrete Buildings (Design of G+3 Storeyed Buildings + Earthquake Analysis & Design)* ", Assorted Editorial; 8th edition (2017).
2. **SP: 34 (1987),"***Handbook on Concrete Reinforcement and Detailing*", Bureau of Indian Standards.
3. **IS: 456 (2000),"***Plain and Reinforced Concrete - Code of Practice*", Bureau of Indian Standards.
4. **SP: 16** (1978),"Design Aids for Reinforced Concrete to IS 456:1978",*Bureau of Indian Standards*.

20CE C104

ADVANCED CONCRETE LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student

1. Understand the stress- strain behavior of high strength concretes
2. Assesses the correlation between cube strength cylindrical strengths, split tensile strength and modulus of rupture of concrete
3. Knows the effect of cyclic loading on steel
4. Grasps the various procedures of conducting non-destructive tests on existing concrete members.
5. Understand the behavior of concrete beams under flexural and shear.
6. Understands the behavior of concrete beams under torsion.

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

1. Deduce the stress - strain values for a given high strength concrete and checks its suitability for a purpose.
2. Interpret the correlation between the cube strength, cylindrical strength split tensile strength And modulus of rupture and determines any missing value among these, others being known.
3. Suggest suitable grade and quantity of steel for resisting cyclic loads.
4. Conduct suitable non-destructive test for the condition assessment of existing concrete members
5. Take proper precaution to avoid flexural and shear failures in concrete beams
6. Strengthen the concrete members to resist torsion.

List of Experiments / Assignments:

1. Study of stress - strain curve of high strength concrete
2. Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
3. Effect of cyclic loading on steel.
4. Non-Destructive testing of existing concrete members.

5. Behavior of Beams under flexure, Shear
6. Torsion

References:

1. A. M. Neville," *Properties of concrete*", 5th Edition, Prentice Hall, 2012
2. M. S. Shetty, "Concrete *technology"*, S. Chand and Co., 2006.

20CE C105

DESIGN OF HIGH-RISE STRUCTURES

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

Course Objectives:

To make the student learn**:**

1. the differences between the regular buildings and tall buildings
2. various structural systems usually considered for the functional design of the tall buildings
3. various methods of calculation lateral forces (both wind forces and seismic/ earth quake forces) on the tall buildings
4. the provisions of relevant IS codes (IS:875 - Part-3, IS:1893 - Part-1) in calculating the lateral forces mentioned above, on tall buildings
5. the importance of ductility of various structural members in resisting the seismic loads on tall buildings and the relevant provisions of the IS code (IS: 13920) regarding the reinforcement detailing in achieving this ductility in RCC members.
6. the concept of performance based design in resisting seismic forces on tall buildings

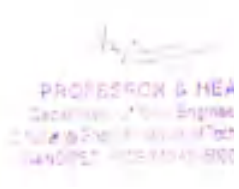
Course Outcomes:

The students can

1. Understand the loads acting on the tall buildings.
2. Learn the concept of analysis of high rise building for wind loads
3. Learn the concept of analysis of high rise building for seismic loads
4. Learn the different structural systems for high rise buildings
5. Learn the assessment of nonlinear performance of the structures

Course Syllabus:

UNIT-I



Introduction:

Importance of Lateral Loads for high rise buildings, types of foundations for tall buildings. Second order effects of gravity loading, Creep and shrinkage in columns, Differential shortening of columns, Floor levelling problems, Panel zone effects, P-Delta effects

UNIT-II

Wind Loads:

Introduction to wind loads, characteristics of wind, Computation of wind loads on buildings as per IS code, Principles of analysis, Introduction to Computational Fluid Dynamics, Wind Tunnel testing.

UNIT-III

Seismic Loads:

Introduction to Earthquakes, Characteristics of Earthquake, Computation of seismic loads on tall buildings – Equivalent static load method, Response Spectrum Method. Vibration Control – active control & passive control. Liquefaction effects, Introduction to Time history Analysis

UNIT – IV

Structural systems:

Necessity of special structural systems for tall buildings, Structural Systems for **Steel Buildings -** Braced frames, Staggered Truss System, Eccentric Bracing System, Outtrigger & Belt truss system, Tube Systems**;** Structural Systems for **Concrete Buildings -** shear walls, frame tube structures, bundled tube structures**;** Design of shear wall as per IS code

UNIT- V

Performance Based Design: Behavior of reinforced concrete members in bending - moment curvature relationship; Plastic hinge, Factors affecting rotation capacity of a section, Plastic moment Redistribution of moments. Pushover Analysis

PROFESSOR & HEA

Suggested Reading:

1. Taranath B. S., "*Structural Analysis and Design of Tall Buildings*", McGraw-Hill Book Company, 1988.
2. Simlu E, "*Wind Effect on Structures: An Introduction to Wind Engineering*", Wile and Sons, 1978.
3. Fintel, M, "*Hand Book of Concrete Engineering*", Von Nostrand, 1974.
4. Emilio Rosenblueth, "*Design of Earthquake Resistant Structures*", Pentech Press Ltd., 1990.
5. Schuellar, W, "*High Rise Building Structures*" , John Wiley & Sons Inc, 1977.
6. Bryan Stafford Smith & Alex Coull, "*Tall Building Structures: Analysis & Design*", Wiley India Pvt Ltd, 1991.
7. Lynn S. Beedle, "*Advances in Tall Buildings*", CBS Publishers and Distributors Delhi, 1996.

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20CE C106

ADVANCED SOLID MECHANICS

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

Course objectives: To enable the student

1. To make the students understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.
2. To enhance the competency level and develop the self-confidence through quality assignments in theory of Elasticity and plasticity.
3. To inculcate the habit of researching and practicing in the field of elasticity and plasticity.

Course Out Comes: The students

1. Will be able to solve the problems of 3-D elasticity with confidence.
2. Can independently work with the problems of 2-D elasticity in Cartesian/Polar Coordinates.
3. Are familiarized with the use of Airy's stress function in 2-D problems of elasticity in Cartesian/Polar Coordinates.
4. Are equipped with the knowledge of various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion.
5. Will be able to solve plasticity problems in Structural engineering

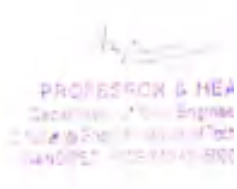
UNIT- I:

Definition of stress and strain: Notation of stresses in three dimensions – Generalized Hooks law.

General Theorems: Differential equations of equilibrium in 3-D - Equations of Equilibrium in terms of displacements – Boundary Conditions - conditions of compatibility - Transformation of stress components under change of co-ordinate system.

UNIT- II:

Plane stress and plane strain: differential equations of equili boundary conditions - compatibility equations



Stresses on an oblique plane – Stress Invariants - principal stresses - stress ellipsoid - max shear stresses - Octahedral shear stress – Strain energy per unit volume - Strain of a line element - principal strains.

UNIT- III:

Two dimensional problems in rectangular coordinates: Stress function Applications - solution by polynomials - Saint- Venant's principle - determination of displacements - bending of simple beams - gravity loading.

Two dimensional problems in polar coordinates: Airy's stress function - general solution of two- dimensional problem in polar coordinates - stress distribution symmetrical about an axis – Effect of hole on stress distribution in a plate in tension, Stresses in a circular disc under diametrical loading - strain components in polar coordinates

UNIT- IV:

Torsion of Prismatic Bars: torsion of prismatic bars - bars with elliptical cross sections – other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsion problems by energy method - use of soap films in solving torsion problems

UNIT- V:

Theory of Plasticity: Introduction – Idealized Stress-Strain curve, concepts and assumptions - yield criterions – Von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-strain relations- Principle of Normality and plastic potential.

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References:

1. Timoshenko S. and Goodier, "*Theory of Elasticity*", Mc Graw hill Publications, 2015.
2. J.Chakraborty,"*Theory of Plasticity*", Mc Graw hill Publications, 2007.
3. S. Singh, "*Theory of Elasticity*", Khanna Publishers, 2003

20CE E107

REPAIR AND RETROFITTING OF STRUCTURE
(ELECTIVE-III)

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

Course Objectives: To enable the student

1. Gain knowledge of Distress and reasons for distress in concrete
2. Learns the basic concepts of serviceability and durability, corrosion etc.
3. Understand the concepts of different repair materials and their suitability
4. Understand the fundamental principles of retrofitting and rehabilitation
5. Learns the basic concepts of Structural health monitoring.

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

1. Identify reasons for distress and suggest remedial measures
2. Analyze the causes for corrosion and identify the durability factors for the safety of structures
3. Identify and suggest various repair materials
4. Analyze and suggest the retrofitting methods
5. Identify the suitable Tests required for SHM

UNIT - I

Maintenance: Repair and rehabilitation - Facets of maintenance - Importance of maintenance various aspects of inspection – Assessment procedure for evaluating damaged structure - Causes of deterioration.
Repair Strategies: Causes of distress in concrete structures – Construction and design failures - Condition assessment and distress-diagnostic techniques - Assessment procedure for inspection a evaluating a damaged structure.

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

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

Repair, rehabilitation and retrofitting techniques: Repairs to overcome low member strength - Deflection - Cracking - Chemical disruption - Weathering corrosion - Wear - Fire - Leakage and marine exposure - Repair of structure – Common types of repairs – Repair in concrete structures – Repairs in under water structures – Guniting – Shot create –Underpinning - Strengthening of structures – Strengthening methods – Retrofitting – Jacketing.

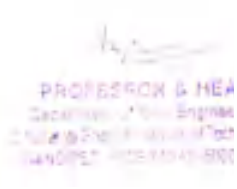
UNIT – V

Health monitoring and demolition techniques: Long term health monitoring techniques - Engineered demolition techniques for dilapidated structures - Use of sensors – Building instrumentation.

Suggested Reading:

1. Barry A. Richardson, "Defects and Deterioration in Building FN Spon Press, London, 1991.

2. J. H. Bungey, “Testing of Concrete in Structures”, Chapman and Hall, New York, 1989.
3. A.R. Santakumar, “Concrete Technology”, Oxford University Press, New Delhi, 2006.
4. B.L. Gupta and Amit Gupta, ‘Maintenance and Repair of Civil Structures”, Standard Publications, New Delhi, 2010.
5. Peter H. Emmons, “Concrete Repair and Maintenance Illustrated”, RS Means, John Wiley & Sons, New York, 1981.
6. W.H. Ransom, “Building Failures: Diagnosis and Avoidance”, E & FN Spon Press, London, 1992.
7. P.K. Mehta and P.J.M. Monteiro, “Concrete - Microstructure, Properties and Materials”, McGraw-Hill, New York, 2014.
8. N. Jackson and R.K, Dhir, “Civil Engineering Materials”, Basingstoke, Macmillan, London, 1988.



20CE E109

DESIGN OF ADVANCED CONCRETE STRUCTURES
(ELECTIVE-IV)

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

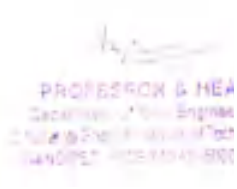
Course objectives: To enable the student

1. To make the students effectively analyse and design Curved and Deep Beams.
2. To enable the students understand the nuances of internal stresses and design of Domes, and thoroughly learn the analysis and design procedures for bunkers and silos.
3. To make the student attain the detailed knowledge to understand the performance of flat slabs and design them by both DDM and EFM.
4. To make the students understand the structural behaviour Raft, Pile and Machine foundations and be able to design them.
5. To make them understand and appreciate the importance of ductile detailing. The student should also be able to design solid shear walls.

Course out Comes: Upon the completion of this course, the student should be able to

1. Analyse and Design curved and deep beam as per the field requirements.
2. be able to find the stresses in domes for various loads and design them.
3. With the thorough knowledge acquired during the course, the student is able to analyzeand design Bunkers and Silos with ease.
4. be able to assess the structural behaviour of Raft, Pile and Machine foundations and design them.
5. Gets reasonable expertise to implement ductile detailing and also design solid shear walls.

UNIT – I:



Beams curved in plan: Introduction – Design Principles – Structural Design of beams circular and semi-circular in plan, continuously and symmetrically supported, rectangular in cross-section.

Deep Beams: Introduction – flexural and shear stresses in deep beams. – I.S. Code provisions – design of simply supported and continuous Deep beams.

UNIT - II:

Domes: Introduction - Stresses and forces in domes - design of spherical and conical domes.

Bunkers and Silos: Introduction - Design principles and theories - IS Code provision - design of rectangular bunkers - design of cylindrical soils.

UNIT – III:

Flat Slabs: Introduction, components, IS code provisions, Design Methods, design for flexure and shear

UNIT – IV:

Pile foundations: Structural design of piles and pile caps.

Raft Foundations: Definitions, Types – Design of Raft foundation, flat plate type and beam-slab type for buildings with column grids up to five by five.

UNIT - V:

Ductile Detailing: Ductile detailing of RCC beams and columns using IS: 13920 -1993 code

Design of Shear Walls: Design and Detailing of Shear Walls considering shear wall-frame interaction in a tall RC structure subjected to seismic loading.

References:

1. N.KrishnaRaju," *Advanced Reinforced Concrete Design*", CBS Publishers, 2005.
2. H.J. Shah, "*Reinforced Concrete"*, Charotar Publishers, 2014.
3. P.C.Varghese, "*Advanced Reinforced Concrete Design"*, PHI, 2005
4. B.C.Punmia, Ashok Kumar Jain," *Comprehensive R.C.C. Designs*", Laxmi Pub. 2005.

20CE A101

DISASTER MITIGATION AND MANAGEMENT

(Audit Course I and II - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	Pass/Fail

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: At the end of the course the student

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected disaster and to suggest and apply appropriate measures for t

5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT- I:

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

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; Geographical based disasters: Tsunami generation, 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 hydro meteorological and geographical based disasters.

UNIT- III:

Human induced hazards: 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 tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multistoreyed buildings.

UNIT- IV: Disaster Impacts: 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.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental responsewater, 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 and the activities of National Disaster Management Authority.

References:

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.
3. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
4. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
5. http://www.indiaenvironmentportal.org.in/files/file/ disaster_management_india1.pdf
6. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
7. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

20CE C107

MODEL TESTING LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student to

1. Learn to estimate natural frequencies and mode shapes of a beam.
2. Understand the evaluation process of dynamic response of a building model using shake table / mini shake table
3. Learn to compute the response of building models to wind loads, using wind tunnel set up.
4. Know the pattern of deflection and cracking in RC slab elements and portal frames under gravity loading.
5. Understands the use of Piezo electric sensors in the determination of vibration characteristics of a beam

Course Outcomes: At the end of the course, student is able to 1. Estimate the natural frequencies and mode shapes of a beam.

2. Evaluate the dynamic response of a building model using shake table / mini shake table set up.
3. Evaluate the response of building models under wind loads, using wind tunnel setup.
4. Determine the pattern of deflection and cracks in RC slab elements and portal frames, under static loading.
5. Use Piezoelectric sensor for the determination of vibration characteristics of a beam.

List of Experiments:

1. Estimation of natural frequencies and mode shapes of a beam.
2. Evaluation of dynamic response of building model using shake table set up.
3. Evaluation of response of building models subjected to wind loads using wind tunnel set up.
4. Deflections and crack pattern study of RC slab elements s to static loading.

5. Deflections and crack patterns in portal frame subjected to gravity loading.
6. Demonstration of use of Piezoelectric Sensors for the determination of Vibration Characteristics of a beam

20CE C108

NUMERICAL ANALYSIS LAB

Instruction (Practical)	4 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	50 Marks
Credits	2

Course Objectives: To enable the student

1. Find Roots of non-linear equations by Bisection method and Newton's method.
2. Do curve fitting by least square approximations
3. Solve the system of Linear Equations using Gauss - Elimination/ Gauss
   - Seidal Iteration/ Gauss - Jordan Method
4. To Integrate Numerically Using Trapezoidal and Simpson's Rules
5. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge- Kutta Method.
6. Apply computational methods in engineering using MAT Lab program

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

1. To find roots of non linear equations by using numerical methods
2. To know how to fit the given data in different curves
3. To know how to solve system of linear equations by using direct and indirect methods
4. To know how to integrate by using numerical methods
5. To find solution of first order ODE by numerical methods
6. To know how to apply computational methods in engineering by using MAT Lab program

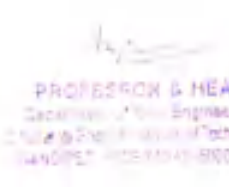
List of Programmes

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Eli Method.

5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jordan Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations by Euler's Method.
10. Numerical Solution of Ordinary Differential Equations by RungeKutta Method.

References:

1. RudraPratap," *Getting started with MATLAB: A quick Introduction for Scientists and Engineers*", Oxford University press, 2010.
2. Grewal B. S," *Numerical Methods in Engineering and Science with Programs in C, C++ & MATLAB*", Khanna Publishers 2014.
3. Dukkipati Rao V, "*Applied Numerical Methods using MATLAB"*, New Age International Pvt. Ltd. Publishers, 2011.



20CE C109

MINI PROJECT WITH SEMINAR

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Outcomes: Students are able to

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

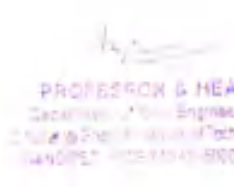
- As part of the curriculum in the II- semester of the programme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modelling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE): Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Progress and Review
	05	Report

Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation



20CE E115

DESIGN OF BRIDGES
(ELECTIVE-V)

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

Course Objectives: To impart the knowledge in various design principles of Bridge Engineering,

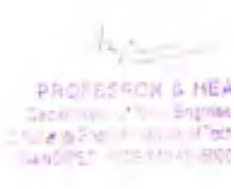
1. The student should be able to design simple bridges individually and be effective contributor in design groups while working on large projects.
2. To make the student conversant with the latest developments in the field of bridge engineering.
3. The student should have a fair familiarity with Indian codes and codes of other countries.

Course Outcomes:

1. Attains ability to design slab and T beam bridges and gets well versed with lateral load distribution for T girders.
2. Acquires sound knowledge about various structural actions of box girder bridges . He also gets the ability to analyse box girders
3. Using some approximate methods and design single cell box girder bridges.
4. Gets thorough knowledge in Railway loadings and can design both Plate girder and Truss girder bridges with ease and efficiency.
5. The student gets comprehensive idea about long span flexible bridges and the problems associated with them. He gets to know the
6. Wind effects and the importance of aerodynamic stability. He also will be able to design elastomeric bearings for bridges.
7. The student gets a clear understanding of bridge foundations and also acquires knowledge about various construction techniques.

UNIT – I:

Introduction: Types of bridges – Materials of construction, Plann layout, Hydraulic design, Provisions of IRC-6 and IRC-21, Design bridges, Design of T-girder bridges, Lateral load distribution in T-be



bridges – Courbon's method, Guyon Massenet method – Design of slabs subjected to concentration loads using Pigeaud's curves.

UNIT – II:

Box girder bridges – various structural actions, Methods of analysis, Beams on elastic foundation method, grillage method and space frame analysis, Shear lag and Edge stiffing effects – Provisions of IRC-18 and IRC-21, Design of simply supported single cell PSC box girder bridge.

UNIT – III:

Steel bridges and composite bridges - Bridge rules and Bridge code of RDSO, Truss girder steel railway bridges – Design of stringer beams, cross girders and truss system, Wind load effects Design of composite bridges as per IRC-22

UNIT – IV:

Long span flexible bridges – suspension bridges and cable stayed bridges – stiffening girders and stress, towers, cables – Importance of wind and aerodynamic stability. Bearings – Types of bearing, Design of elastomeric bearings

UNIT – V:

Sub structure – Piers and towers – Types of forces, Stability analysis of solid type piers, Types of bridge foundations and their design principles, Construction techniques – Cast in-situ, Prefabricated, Incremental launching and Free cantilever construction techniques.

References:

1. Wai-Fah Chen LianDuan , "*Bridge Engineering Handbook*",, CRC Press, USA, 2000
2. R. M. Barker and J. A. Puckett, John Wiley & Sons, "*Design of Highway Bridges*", New York, 1997
3. P. P. Xanthakos, John Wiley & Sons, "*Theory and Design of Bridges*", New York, 1994
4. Raja Gopalan, "*Bridge Superstructure"* – Narosa Publishing – 2010.
5. N. KrishnamRaju, "*Design of Bridges"* Oxford and IBH Publishing – 2010.
6. Johnson Victor, "*Essentials of Bridge Engineering*", Oxfor[illegible] Publishers, Sixth edition 2018.

PROFESSOR & HEA

20CS O101

BUSINESS ANALYTICS (OPEN ELECTIVE – Common to All Branches)

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

Course Objectives: The main objectives of this course are to

1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

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

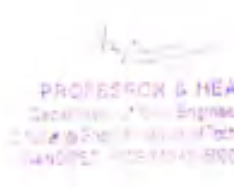
1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

Unit-I:

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

Unit-II:

Descriptive Analytics: Introduction, data types and scales, t measurement scales, population and samples, measures of central te



percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

Unit-III:

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

Unit-IV:

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics-** Linear Programming(LP) and LP model building,

Unit-V:

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

References:

1. U Dinesh Kumar, "*Data Analytics*", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "*Business analytics Principles, Concepts, and Applications with SAS*", Associate Publishers, 2015
3. S. Christian Albright, Wayne L. Winston, "*Business Analytics - Data Analysis and Decision Making*", 5th Edition, Cengage, 2015

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

20EE O101

WASTE TO ENERGY (OPEN ELECTIVE – Common to All Branches)

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

Course objectives: To make the students to

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course outcomes: After completion of this course, students will be able to:

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes Thermo chemical conversion - Direct combustion - biomass gasification pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Desai, Ashok V.," *Non-Conventional Energy"*, Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. andMahdi, S. S., *Biogas Technology - A Practical Hand Book",* Vol.I &II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Challal, D. S, "*Food, Feed and Fuel from Biomass"*, IBH Publishing Co. Pvt. Ltd., 1991.
4. C. Y. WereKo-Brobby and E. B. Hagan," *Biomass Conversion and Technology*", John Wiley & Sons, 1996.

20CE C110

DISSERTATION PHASE-I

Instruction	20 Hours per week
Duration of Semester End Examination	0 Hours
Semester End Examination	0 Marks
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed Journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present. 5. Student will defend their work in front of technically qualified audience.

Guidelines:

The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution andmust preferably bring out the individual contribution.

Seminar should be based on the area in which the candidate has undertaken the dissertation work.

The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also bediscussed in the report.

The work has to be presented in front of the committee consists ofHead, Chairperson-BoS, Supervisor and Project coordinator.

The candidate has to be in regular contact with his supervisor and thetopic of dissertation must be mutually decided by the guide and student.

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	3	1	3	--
CO2	2	2	2	1
CO3	-	3	-	2
CO4	-	3	-	2
CO5	3	2	2	2

Note: Department committee has to assess the progress of the student for every two weeks.

Guidelines for the award of Marks:		Max. Marks: 100
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
ME (STRUCTURAL ENGINEERING)
(With effect from the academic year 2020-21)

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	
PRACTICALS									
1	20CE C111	Dissertation Phase-II	0	0	32	-	100	100	16
TOTAL			**0**	**0**	**32**	**-**	**100**	**100**	**16**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

20CE C111

DISSERTATION PHASE-II

Instruction	32 Hours per week
Duration of Semester End Examination	Viva
Semester End Examination	100 Marks
CIE	100Marks
Credits	16

Course Outcomes: At the end of the course

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipment's and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	2	2	3	2
CO3	2	1	3	2
CO4	3	2	3	2
CO5	3	3	2	2

Guidelines:

It is a continuation of Project work started in semester III.
The student has to submit the report in prescribed format and also present a seminar.
The dissertation should be presented in standard format as provided by the department.
The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of

solution and results and discussion.
The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.

The candidate has to be in regular contact with his/her guide/coguide.

Guidelines for awarding marks in CIE:		Max. Marks: 100
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report reportstandard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE: (Max. Marks: 100) Max. Marks: 100

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project
		Innovations
		Applications
		Live Research Projects
		Scope for future study
		Application to society
	20	Viva-Voce

AUDIT COURSES

20EG A101

ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course I and II - Common to all branches)

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

Course Objectives: The Course will introduce the students to

1. To understand the nuances of language and vocabulary in writing a Research Paper.
2. To develop the content, structure and format of writing a research paper.
3. To enable the students to produce original research papers without plagiarism.

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

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	--	3	1	-
CO2	--	3	1	-
CO3	1	3	1	-
CO4	--	3	1	--
CO5	--	3	1	1

UNIT -1:

Academic Writing

Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT- II:

Research Paper Format

Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT –III:

Research Methodology

Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT- IV:

Process of Writing a research paper

Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft–Revising/Editing - The final draft and proof reading.

UNIT- V:

Research Paper Publication

Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications– / Advantages/Benefits

References:

1. C. R Kothari, Gaurav, Garg, **Research Methodology Methods and Techniques,** New Age International Publishers. 4th Edition.
2. Day R (2006) "*How to Write and Publish a Scientific Paper*"**,** Cambridge University Press
3. **MLA "***Hand book for writers of Research Papers***"**, East West Press Pvt. Ltd, New Delhi, 7th Edition.
4. LauriRozakis, Schaum's, "*Quick Guide to Writing Great Research Papers",*Tata McGraw Hills Pvt. Ltd, NewDelhi.

Online Resources:

1. NPTEL:https://onlinecourses.nptel.ac.in/noc18_mg13/preview

20CE A101

DISASTER MITIGATION AND MANAGEMENT

(Audit Course I and II - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	Pass/Fail

Course Objectives: To enable the student

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronologicalphases ina disaster management cycle and to create awareness aboutthe disaster management framework and legislations in the context of national and global conventions

Course Outcomes: At the end of the course the student

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same

5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	2	1	2	2
CO2	2	1	2	2
CO3	1	1	2	2
CO4	2	1	2	2
CO5	2	1	2	2

UNIT- I:

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

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; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studiesrelated to various hydro meteorological and geographical based disasters.

UNIT- III:

Human induced hazards: 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 tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multistoreyed buildings.

UNIT- IV: Disaster Impacts: 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.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental responsewater, 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 and the activities of National Disaster Management Authority.

References:

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.
3. Ministry of Home Affairs". *Government of India, "National disaster management plan, Part I and II",*
4. K. K. Ghosh," *Disaster Management",* APH Publishing Corporation, 2006.
5. http://www.indiaenvironmentportal.org.in/files/file/ disaster_management_india1.pdf
6. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
7. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

20EE A101

SANSKRIT FOR TECHNICAL KNOWLEDGE

(Audit Course I and II - Common to all branches)

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

Course Objectives: To enable the student

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

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

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature 3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	--	--	--	-
CO2	-	--	1	-
CO3	--	--	1	1
CO4	1	--	1	1
CO5	1	--	1	1

UNIT-I:

Introduction to Sanskrit language: Sanskrit Alphabets-vowels-consonantssignificance of Amarakosa-parts of speech-Morphology-creation of new wordssignificance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/ Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II:

Role of Sanskrit in Basic sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pieMadhava's sine and cosine theory (origination of Taylor's series).

The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III:

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definitioncrucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingalachandasutram (origination of digital logic system)

UNIT-IV:

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languagescomputer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V:

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures

Chemical laboratory location and layout-equipment-distillation vesselkosthiyanthram-

References:

1. M Krishnamachariar, "*History of Classical Sanskrit Literature*", TTD Press, 1937.
2. *M.R. Kale, "A Higher Sanskrit Grammar: For the Use of School and College Students*", Motilal Banarsidass Publishers, ISBN-13: 9788120801783, 2015
3. KapailKapoor,"*Language, Linguistics and Literature: The Indian Perspective*", ISBN-10: 8171880649, 1994.
4. "*Pride of India, Samskrita Bharati Publisher*", ISBN: 81-87276-27-4, 2007

5. ShriRamaVerma, "*Vedas the source of ultimate science*", Nag publishers, ISBN:81-7081-618-1, 2005

20EC A101

VALUE EDUCATION

(Audit Course I and II - Common to all branches)

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

Course Objectives: This course aims to

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes: After completion of the Course, Students will be able to

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	--	--	--	1
CO2	--	--	--	1
CO3	--	--	1	1
CO4	--	--	--	1
CO5	--	--	--	1

UNIT I:

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards

and principles based on religion, culture and tradition.

UNIT II:

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT III:

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT IV:

Values in Holy Books : Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT V:

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

References:

1. Chakroborty, S.K. "*Values & Ethics for organizations Theory and practice*", Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, "*Srimad Bhagavad Gita", withSanskrit Text"*, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

20EG A102

INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS
(Audit Course I and II -Common to all branches)

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

Course Objectives: The course will introduce the students to

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil andeconomic rights as well as the emergence of nationhood in the earlyyears of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

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

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

Articulation Matrix's

COs	PO1	PO2	PO3	PO4
CO1	-	-	-	1
CO2	-	-	-	1
CO3	-	-	-	1
CO4	-	-	-	1
CO5	-	-	-	1

UNIT-I:

History of making of the Indian constitutions: History, Drafting Committee (Composition &Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II:

Contours of Constitutional Rights and Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III:

Organs of Governance Parliament: Composition, Qualifications, Powers and Functions

Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV:

Local Administration: District's Administration head: Role and importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: ZillaPanchayat, Elected Officials and their roles, CEO ZillaPanchayat: positions and role. **Block level**: Organizational Hierarchy (Different departments)Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V:

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

References:

1. *"The Constitution of India"*, 1950 (Bare Act), GovernmentPublication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "*Framing of Indian Constitution"*, 1st Edition,2015.
3. M. P. Jain, "*Indian Constitution La"w*, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu,"*Introduction to the Constitution of India"*, Lexis Nexis,2015.

Online Resources:

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

20IT A101

PEDAGOGY STUDIES

(Audit Course I and II - Common to all branches)

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

Course Objectives: The students will be able

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

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

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	1	1	1	1
CO2	1	1	1	1
CO3	1	1	1	1
CO4	1	1	1	1
CO5	1	1	1	1

UNIT-I:

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II:

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III:

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV:

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V:

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

References:

1. Ackers J, Hardman F, "*Classroom Interaction in Kenyan Primary Schools, Compare*", 31 (2): 245 – 261, 2001.
2. Agarwal M, "*Curricular Reform in Schools: The importance of evaluation*", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.
3. Akyeampong K, "*Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)"*, Country Report 1.London: DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "*Improving teaching and learning of Basic Maths and Reading in Africa: Does*

teacher Preparation count"?, International Journal Educational Development, 33 (3): 272- 282, 2013.

5. Alexander R J, "*Culture and Pedagogy: International Comparisons in Primary Education",* Oxford and Boston: Blackwell, 2001.
6. Chavan M, "*Read India: A mass scale, rapid, 'learning to read'* campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pd f.

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20EG A103

STRESS MANAGEMENT BY YOGA

(Audit Course I and II - Common to all branches)

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

Course Objectives: The Course will introduce the students to

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

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

1. To understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	--	--	--	1
CO2	--	--	--	1
CO3	--	--	--	1
CO4	--	--	--	1
CO5	--	--	--	1

UNIT- I:

Meaning and definition of Yoga - Historical perspective of Yoga **-** Principles of Astanga Yoga by Patanjali.

UNIT –II:

Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT -III:Concept of Stress according to Yoga - Stress assessment methods Role of Asana, Pranayama and Meditation in the management of stress.

UNIT- IV:

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT- V:

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.**Meditation techniques:** Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

References:

1. "*Yogic Asanas for Group Training - Part-I":*Janardhan Swami YogabhyasiMandal, Nagpur.
2. "*Rajayoga or Conquering the Internal Nature*"by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.
3. Nagendra H.R nadNagaratna R, "*Yoga Perspective in Stress Management"*, Bangalore, Swami Vivekananda Yoga Prakashan

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

20EG A104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

(Audit Course I and II - Common to all branches)

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

Course Objectives: The course will introduce the students to

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom among themselves.

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

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. To practice emotional self-regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

Articulation Matrix

COs	PO1	PO2	PO3	PO4
CO1	--	--	--	1
CO2	--	--	--	-
CO3	--	--	--	-
CO4	--	--	--	1
CO5	--	--	--	1

UNIT-I:

Neetisatakam - Holistic development of personality: Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II:

Neetisatakam – Holistic development of personality (cont'd): Verses 52, 53,

59 (dont's) - Verses 71,73,75& 78 (do's) - Approach to day to day works and duties.

UNIT-III:

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagawad Geeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter18–Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV:

Statements of basic knowledge - ShrimadBhagawadGeeta: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT-V:

Role of Bahgavadgeeta in the present scenario : Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

References:

1. "*Srimad Bhagavad Gita*" , Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. *"Bhartrihari's Three Satakam* (Niti-sringar-vairagya)",P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Online Courses:

1. NTPEL: http://nptel.ac.in/downloads/109104115/