Preface

University Grant Commission vide Letter No. F. 2–10/2023 (AC–Policy) dated 19th January 2024 conferred the autonomous status to St. John College of Engineering and Management, Village Vevoor, Manor Road, Palghar (East), 401404 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations 2023. Designing the curriculum as an autonomous institution raises challenges pertaining to maintaining quality engineering education.

Systematic approach has been adapted in the design and implementation of curriculum with the intent of ensuring quality education catering to the sensitive needs of a learner, society, and industry. The curriculum is aligned with NEP and UGC guidelines as per Government of Maharashtra guidelines for autonomous institutions Government Resolution dated 4th July 2023.

Based on recent recommendations of the GR, holistic curriculum for 2024-28, a "H-Tree Model" of Engineering Education is offered. A unique "H-Tree Model" of Engineering Education Curriculum is followed and curriculum is designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient), and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an all-rounded personality with holistic approach to education in which a learner receives 34% teacher-led learning, 15% peer learning, 26% self-learning, and 25% experiential learning. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to a leaner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science and mathematics foundation and program core, sequel of electives, multidisciplinary minor courses, humanities & management courses, and sufficient experiential learning through projects and semester-long industry/research internship along with employable skill-based courses. A learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Additional options of choosing from Honors/Double Minor/Honors with Research are also provided to a learner.

The curriculum balances contact hours and total credits of the entire program. The total credits are 172, wherein focus is not only on providing knowledge but also on building skills, attitude and self-learning. Therefore, in the present curriculum, skill-based laboratories, mini-projects, multi-disciplinary projects, and internships are made mandatory across all disciplines of engineering, which will definitely facilitate self-learning of students. The overall credits and approach of curriculum proposed in the scheme and syllabus are in line with AICTE model curriculum. SJCEM R-24 curriculum will be implemented for Second Year of Engineering from the academic year 2024-25. It will be carried forward for Third Year and Final Year Engineering in subsequent academic years. SJCEM RO-24 curriculum will be implemented for Third Year and Fourth Year of Engineering from the academic year 2024-25.

Bachelor of Engineering
In
Civil Engineering

Second Year
Semester – III

REVISION: SJCEM RO – 24

Effective from Academic Year 2024-25

Board of Studies Approval:
Academic Council Approval:

Curriculum Structure for UG Programs at SJCEM w.e.f. A.Y. 2024-25

Nomenclature of the courses in the curriculum	
Abbreviation	**Title**
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Program Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
SC	Skill Courses
LLC	Liberal Learning Courses
VSEC	Vocational and Skill Enhancement Course
VSC	Vocational Skill Courses
SEC	Skill Enhancement Courses
AEC	Ability Enhancement Course
IKS	Indian Knowledge System
CC	Co-curricular Courses

Credit Specification:

- Theory: 1 credit = 15 hrs of teaching
- Lab: 1 Credit = 30 hrs of lab work.
- Workshop Based Activities: 1 Credit = 30 hrs of hands-on activities related to vocation/professional practice/skill based
- Seminar/Group Discussion: 1 Credit= 13 to 15 hrs of participation
- Community Engagement Projects: 1 Credit = 26 to 30 hrs of contact time along with 13 to 15 hrs of activities preparation, report writing, independent reading etc.

Dr. B.J.Godboley
HOD

Dr. Gopal V. Mulgund
Principal

Program Structure for Second Year III Semester, Civil Engineering

St. John College of Engineering and Management (Autonomous)

(With Effect from 2024-2025)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CEPCC301	PCC	Mathematics for Civil Engineering	3	1	-	3	1	-	4
24CEPCC302	PCC	Geology and Basics of Geotechnologogy	3	-	2	3	-	1	4
24CEPCC303	PCC	Fluid Mechanics	3	-	2	3	-	1	4
24CEPCC304	PCC	Strength of Materials	3	-	2	3	-	1	4
24CEPCC305	PCC	Building Planning and Computer-Aided Civil Engineering Drawing	-	-	4	-	-	2	2
24CEVEC301	VEC	Universal Human Values-2	2	1*	-	2	1	-	3
24CEAEC301	AEC	Basic Communication Skills – II (BCS-II)	1	-	-	1	-	-	1
		Total	**15**	**1**	**10**	**15**	**2**	**5**	**22**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA (TW)	OR/PR	Total
24CEPCC301	PCC	Mathematics for Civil Engineering	20	20	60	25	-	125
24CEPCC302	PCC	Geology and Basics of Geotechnologogy	20	20	60	25	25	150
24CEPCC303	PCC	Fluid Mechanics	20	20	60	25	25	150
24CEPCC304	PCC	Strength of Materials	20	20	60	25	25	150
24CEPCC305	PCC	Building Planning and Computer-Aided Civil Engineering Drawing				50	50	100
24CEVEC301	VEC	Universal Human Values-2	10	10	30	25	-	75
24CEAEC301	AEC	Basic Communication Skills – II (BCS-II)	-	-	-	25	-	25
		Total	**90**	**90**	**270**	**200**	**125**	**775**

Sr. No.	Heading	Particulars
1	Title of the Course	Second Year Engineering(Civil Engineering)
2	Eligibility for Admission	After Passing HSSC / 12th (10+2) / Diploma as per the Institute Examination Ordinance
3	Theory Passing Marks (IAE / ESE)	40%
4	Continuous Assessment (CA) / Oral / Practical	50%
5	To be implemented from AcademicYear	With effect from AcademicYear:2024-2025

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE): Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE): End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) : Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam: Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

St. John College of Engineering and Management
Autonomous Institute
(A Christian Religious Minority Institution)
Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE
DTE Code : 3218 AICTE Permanent ID : 1-4790201
NAAC Accredited with Grade 'A+', Three Programs NBA Accredited

III Semester

DEPARTMENT OF CIVIL ENGINEERING

Mathematics for Civil Engineering

Semester: III			Term: Odd			Course Code: 24CEPCC301					
Teaching Scheme						Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	1	-	3	1	-	4	20	20	60	25	-	125

IAE: Internal Assessment Examination, ESE: End Semester Examination, TW: Term Work

Course Objectives: The course is aimed

1. To develop a solid understanding of the basic concepts related to infinite series, including convergence, divergence, and the behaviour of sequences.
2. Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
3. To familiarize with the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
4. To become familiar with numerical methods for solving partial differential equations
5. To familiarize with the concepts of statistics for data analysis.
6. To study the Matrix algebra and its application in engineering problems.

Course Outcomes:

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

1. Determine whether an infinite series converges (approaches a finite limit) or diverges (does not approach a finite limit) using various convergence tests
2. Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
3. Apply the concept of Laplace transform & inverse Laplace transform of various functions in engineering problems.
4. Solve Partial differential equations by applying numerical solution and analytical methods for one dimensional heat equation.
5. Use the concept of probability distribution and sampling theory to engineering problems.
6. Apply the concepts of eigenvalues and eigenvectors to solve engineering problems.

Module	Contents	Hours	COs
I	**Infinite Series** Introduction, Positive term series, Comparison test, Cauchy's root test, D' Alembert's test, Logarithmic test, Integral test, Gauss's test, Series with arbitrary terms. **Self-learning Topics:** Raabe's test, Rearrangement of terms.	6	1

II	**Fourier Series** Definition, Fourier series with arbitrary period, in particular periodic function with Period 2π, Fourier series of even and odd function, Half range Fourier series **Self-learning Topics:** Parseval's Identity, Complex form of Fourier Series, orthogonal and orthonormal set of functions	6	2
III	**Laplace Transforms** Introduction, Definition, Existence conditions, basic properties, Inverse Laplace transform and properties, Convolution Theorem and properties, Applications of Laplace transforms to solve initial and boundary value problems involving Ordinary Differential Equations. **Self-learning topics**: Second Shifting theorem, Heaviside's Unit Step function, Dirac Delta Function.	10	3
IV	**Partial Differential Equation** Second order PDE of Mathematical Physics Heat, wave and Laplace equation, one dimensional with standard boundary conditions, Crank Nicholson method, Bender Schmidt method **Self-learning Topics:** Solution by separation of variable method using Fourier series, Solution by Separation of variables and transformation Techniques	7	4
V	**Statistics** Correlation between two variables, application of correlation, evaluation of coefficients of correlation, Rank correlation, Regression, frequency distribution, Binomial, Poisson's distribution and Normal distribution, application to industrial problems. Test of significance, student's t- test, application of the t-test, Chi-square test, F-test (significant difference between variances of two samples) **Self-learning Topics**: Bernoulli's Distribution, Uniform Distribution, Test of significance of large samples, Yate's Correction, ANOVA: One way Classification	10	5

VI	**Linear Algebra (Matrices)** Characteristic equation, Eigenvalues and Eigenvectors, Properties of Eigenvalues and Eigenvectors. (No theorems/ proof), Cayley-Hamilton theorem (without proof): Application to find the inverse of the given square matrix and to determine the given higher degree polynomial matrix **Self-learning Topics**: Functions of square matrix, Similarity of matrices, Diagonalization of matrices, Minimal polynomial and Derogatory matrix,	6	6

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

1. CA should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Reference Books

1. E Kreyszig, Advanced Engineering Mathematics, John Wiley, New Jersey. 1995.
2. C R Wiley, Advanced Engineering Mathematics, McGraw-Hill, New York, 1993.

Text Books:

1. Peter O'Niel, Advanced Engineering Mathematics, Thompson, Singapore, 2002.
2. M D Greenberg, Advanced Engineering Mathematics, Pearson, Singapore, 2007.
3. B V Ramana, Higher Engineering Mathematics, The MaGraw-Hill Inc., New Delhi

Useful Links

1. https://www.youtube.com/watch?v=d7NF-_8vVv4&list=PLyqSpQzTE6M8gnapvdLN92hs_4F75OSuH
2. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE
3. https://www.youtube.com/watch?v=uQu_bArt5TY&list=PLmPb6ufFFS_zcG2qX3olxex7AsnknV4Z-&index=27

Geology and Basics of Geotechnology

Semester: III			Term:				Course Code: 24CEPCC302					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE-1	IAE-2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination, ESE: End Semester Examination, TW: Term Work

Course Objectives- ***The objective of the content titled is to equip learners with the ability to:***

1. Analyse the physical characteristics of soil, focusing on texture and structure, and understand how these characteristics influence soil properties.
2. To equip students with the skills to interpret and prepare geologic maps and sections and to analyze the chemical and physical properties of minerals in rocks and soils
3. Understand the fundamental principles of soil and rock classification, including the identification and characterization of different rock types.
4. Conducting subsurface investigations using both intrusive and non-intrusive methods, and to understand the engineering properties and index measurements of soil and rock.
5. To study origin and mode of formation of soil as well as functional relationships among different unit weights, volumetric ratios, and water content.
6. To study clay mineralogy and plasticity characteristics of soils.

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

1. Analyse the processes of soil formation, evaluate soil properties based on texture and structure
2. Apply techniques of geologic mapping and remote sensing, as well as to conduct chemical and physical analyses of rock and soil minerals for engineering applications.
3. Apply established classification schemes (IUGG for igneous rocks) to differentiate and classify
4. Evaluate subsurface conditions using drilling, sampling, and geophysical methods, and assess the engineering properties and strength indices of soil and rock.
5. Explain the basic concepts of the physical and engineering properties of soil and derive the relationships among various unit weights & other parameters.
6. Comprehend clay mineralogy and plasticity behavior of clay.

Module No	Content	Hrs	CO
I	**Introduction (Formation, Properties, and Classification):** Origin and development of soil, Weathering processes, transportation and sedimentation processes, structure, texture and classification, **Self-Learning:** surficial deposits and landforms	05	CO-1
II	**Geological Investigations** **Geologic Mapping and Remote Sensing:** Topographic maps, geologic maps, preparation of geologic sections, aerial photographs, LIDAR, SAR, GIS **Mineralogy:** Chemical analysis of rocks and minerals, rock and soil minerals, **Self-Learning:** physical properties of minerals.	08	CO-02
III	**Classification of Soil and Rock:** Types of rock and origin: Igneous, sedimentary and metamorphic. **Igneous Rock:** Agents, structure, texture, IUGG classification of intrusive and extrusive rocks **Metamorphic Rock:** Causes of metamorphism (stress, temperature, tectonism, pore fluid), recrystallization, phase change, structure and texture **Sedimentary Rock:** Sedimentation environments, structure, textural **Self-Learning:** Classification of Siliclastic and carbonate rock.	08	CO-03
IV	**Subsurface exploration:** Intrusive and non-intrusive sub-surface investigation, geologic investigations for site selection of dams, reservoirs, tunnels, bridges and highways **Engineering Properties of Soil and Rock**: Engineering properties (density, unit weight, porosity), strength, index measurements for soil and rock (SPT blow count, RQD, RMR, Point Load Index), **Self-Learning:** Relationships of index measurements with strength of soil and rock.	08	CO-04
V	Introduction to Geotechnical Engineering, Basic Definitions & Relationships: Definitions and scope of Geotechnical Engineering: rocks, soil, origin & mode of formation and types of soil obtained, soil mechanics, rock mechanics, geotechnical engineering. Soil phase systems, volumetric ratios: Weight-volume relationship: different unit weights, water content, specific gravity of soil solids, mass and absolute specific gravity. Relative density, relative compaction. **Self-Learning:** Different methods to determine water content, specific gravity and unit weight of soil.	08	CO-05
VI	Clay Mineralogy and Plasticity Characteristics of Soils: Explanation about clay minerals, e.g., Montmorillonite, Illite and Kaolinite; formation of clay minerals and their role in plastic behavior of soil. Definition of plasticity of soil, consistency of soil, definition & determination of liquid limit, plastic limit, shrinkage limit. Definitions of shrinkage parameters, plasticity index, liquidity index,	08	CO-06

	consistency index, flow index, toughness index, activity. **Self-Learning:** Sensitivity and thixotropic of soil. Importance of consistency limits.		

Exp. No.	List of Experiments	CO Mapping
1	Investigating Soil Classification:	CO-01
2	Identification of common Rock forming minerals on the basis of physical Properties	CO-02
3	Identification of Metallic minerals: Galena, Pyrite, Hematite, Magnetite.	CO-02
4	Identification of rocks: Igneous Rocks	CO-03
5	Identification of rocks: Sedimentary Rocks	CO-03
6	Identification of rocks: Metamorphic Rocks	CO-03
7	Calculation of RQD from the given data and assessment of rock quality.	CO-04
8	Assessment of the geological conditions for a proposed dam site in the given map.	CO-04
9	Determination of natural moisture content of soil using oven drying method	CO-05
10	Specific gravity of soil grains by density bottle method or Pycnometer method	CO-05
11	Determination of liquid (Casagrande method), plastic and shrinkage Limits	CO-06

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

1. CA work should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15marks) examination will be conducted.

Recommended Books:

1. Text book of Engineering Geology: N. Chenna, Kesavulu, Mc-Millan.
2. Text book of Engineering and General Geology, 8th edition (2010): Parbin Singh, S K Kataria& Sons.
3. Text book of Engineering Geology: P. K. Mukerjee, Asia.
4. Text book of Engineering Geology: Dr. R. B. Gupte, Pune VidyarthiGriha Prakashan, Pune.
5. Principles of Engineering Geology: K. M. Banger.
6. Soil Mechanics and Foundation Engineering: K. R. Arora; Standard Publishers and Distributors, New Delhi.
7. Soil Mechanics and Foundations: B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain; Laxmi Publications (P) LTD., New Delhi

Reference Books:

1. A Principles of Physical Geology: Arthur Homes, Thomas Nelson Publications, London.
2. Structural Geology, 3rd edition (2010): Marland P. Billings, PHI Learning Pvt. Ltd. New Delhi
3. Earth Revealed, Physical Geology: David McGeeary and Charles C. Plummer
4. Principles of Geomorphology: William D. Thornbury, John Wiley Publications, New York.
5. Geology for Civil Engineering: A. C. McLean, C.D. Gribble, George Allen &UnwinLondon.
6. Engineering Geology: A Parthsarathy, V. Panchapakesan, R Nagarajan, Wiley India 2013.
7. An Introduction to Geotechnical Engineering: Robert D. Holtz, William D. Kovacs; Prentice-Hall, New Jersey
8. Soil Mechanics: R. F. Craig; Spon Press, Taylor and Fransis Group

FLUID MECHANICS

Semester: III			Term:				Course Code: 24CEPCC303					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE-1	IAE-2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination, ESE: End Semester Examination, TW: Term Work

Course Objectives- ***The objective of the content titled is to equip learners with the ability to:***

1. Apply the fundamental concepts of fluid mechanics to solve problems encountered in civil engineering.
2. Utilize their knowledge of fluid statics, kinematics, and dynamics to analyze various engineering scenarios.
3. Demonstrate an understanding of pressure measurement, hydrostatic forces, and buoyancy principles.
4. Employ a mechanistic perspective to tackle problems involving pipe flow, open channel flow, jets, turbines and pumps, dams and spillways, culverts, river and groundwater flow.
5. Use techniques for measuring fluid flow rates and properties
6. Analyze and solve pipe flow problems by applying the principles of fluid mechanics and understanding head loss concepts in pipe systems.

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

1. Apply the fundamental concepts of fluid mechanics to solve problems encountered in civil engineering.
2. Utilize their knowledge of fluid statics, kinematics, and dynamics to analyze various engineering scenarios.
3. Demonstrate an understanding of pressure measurement, hydrostatic forces, and buoyancy principles
4. Analyse and solve problems involving various fluid flow applications (e.g., pipe flow, open channel flow, jets, turbines, pumps) using a mechanistic perspective.
5. Evaluate and select appropriate techniques for measuring fluid flow rates and properties based on the specific application.
6. Analyse and solve pipe flow problems by applying the principles of fluid mechanics and understanding head loss concepts in pipe systems.

Module	Contents	Hrs	COs
I	**Basic Concepts and Definitions:** Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, **Self-Learning:** Bulk modulus of elasticity, compressibility.	05	CO-01
II	**Hydrostatics:** Pressure and its measurement, fluid pressure at a point, Pascal's law, pressure and its relation with height, atmospheric, absolute, gauge and negative pressure, measurement of pressure through piezo-meter and various types of manometers. Total pressure, intensity of pressure, centre of pressure. Pressure on horizontal, vertical, inclined and curved surface. Buoyancy, centre at Buoyancy, Meta centre and Meta centre height. Condition of equilibrium of floating and submerged body. Experimental and analytical method. **Self-Learning:** determine Meta-centric height. Pressure in case of accelerated rigid body motion.	09	CO-02
III	**Fluid Kinematics:** Types of fluid motion, methods of describing fluid flow Langrangian and Eulerian method, Inviscid flows, velocity and acceleration, flow rate, Continuity equation, Potential flows, flow lines, velocity potential and stream function, Flownet its characteristic and utility, circulation and vorticity, Vortex flow - forced vortex flow, free vortex flow, equation of motion for vortex flow. **Self-Learning:** equation of forced vortex flow and free vortex flow.	09	CO-03
IV	**Fluid Dynamics-** Energy processed by a fluid body, Types of forces, Forces influencing fluid motion, head-energy correction factor, Euler and Bernoulli's equations, application of Bernoulli's equation, Flow measurement, momentum of fluid in motion, momentum equation and momentum correction factor. **Self-Learning:** Application of momentum equation, forces on a pipe bend, free jets	08	CO-04

V	**Measurement of Flow:** Orifice & Mouth piece Classification, hydraulic coefficients, experimental determination of hydraulic coefficient, discharge through all types of office & mouthpieces, time of emptying the tank through orifice and mouthpiece, Notches and Weirs Classification, discharge through various types of Notches and weirs, time of emptying a reservoir or a tank with notches & weirs. **Self-Learning:** Orifice meter Venturi meter, Nozzles and bend meter,	08	CO-05
VI	**Flow Through Pipes:** Introduction, Major and minor losses of energy in pipes, hydraulic gradient, total energy line, pipes in series, pipes in parallel, **Self-Learning:** flow through branched pipes, and hydraulic transmission of power	06	CO-06

Exp. No.	List of Experiments	CO Mapping
1	Measurement of viscosity	CO-01
2	To determine specific gravity of a given liquid	CO-01
3	Experiment of Buoyancy and determination of Meta Centre height	CO-02
4	Experiment of Hydrostatic Pressure (relation P = wh)	CO-02
5	To study laminar and turbulent flow and its visualization on Reynold's Apparatus	CO-03
6	Construction of Flow net	CO-03
7	Investigating the validity of the Bernoulli equation	CO-04
8	Determination of coefficient of discharge of Venturimeter.	CO-04
9	Determination of coefficient of discharge of Orifice meter	CO-04
10	Determination of coefficient of discharge of Nozzle meter	CO-04
11	Determination of coefficient of discharge of mouthpiece.	CO-05
12	To measure the flow using different notches	CO-05
13	To determine loss coefficients for different pipe fittings	CO-06
14	To determine Fluid friction factor for the given pipes	CO-06

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

1. CA should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	**Attendance (Theory & Practical)**	**Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference**
10 marks	05 marks	10 marks

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15marks) examination will be conducted.

Recommended Books:

1. Hydraulics and Fluid mechanics: Dr. P.M. Modi and Dr. S.M. Seth, Standard Book House, Delhi

2. Theory and Application of Fluid Mechanics: K. Subramanian, Tata McGraw hill publishing company, New Delhi.
3. Fluid Mechanics: Dr. A.K Jain, Khanna Publishers.
4. Fluid Mechanics and Hydraulics: Dr. S.K. Ukarande, Ane's Books Pvt.Ltd. (Revised Edition2012), ISBN 97893 8116 2538
5. Fluid Mechanics and fluid pressure engineering: Dr. D.S. Kumar, F.K. Kataria and sons
6. Fluid Mechanics: R.K. Bansal Laxmi Publications (P) Ltd.

Reference Books:

1. Fluid Mechanics: Frank M. White, Tata McGraw Hill International Edition.
2. Fluid Mechanics: Streeter White Bedford, Tata McGraw International Edition.
3. Fluid Mechanics with Engineering Applications: R.L. Daugherty, J.B. Franzini, E.J. Fennimore, Tata McGraw Hill, New Delhi.
4. Hydraulics: James F. Cruise, Vijay P. Singh and Mohsen M. Sherif, CENGAGE Learning India (Pvt.) Ltd.
5. Introduction to Fluid Mechanics: Edward J. Shaughnessy, Jr, Ira M. Katz, James P. Schaffer. Oxford Higher Education.

Strength of Materials

Semester: III			Term: ODD				Course Code: 24CEPCC304					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted									
Th	Tu	Pr	Th	Tu	Pr	Total Credit	IAE-1	IAE-2	ESE	CA	OR/PR	Total
3	--	2	3	--	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination; ESE: End Semester Examination; TW: Term Work

Course Objectives:

1. To learn stress-strain behavior and physical properties of materials and to compute the Stresses developed and deformation in various cross sections of Elastic members.
2. To learn to understand variation of shear force and bending moment along the length of statically determinate beams for various loads and its combinations.
3. To compute and analyses Shear and Bending stresses in beams.
4. To study circular shafts under the action of twisting moment and buckling behavior of centrally loaded columns.
5. To determine principal planes and stresses and strain energy computation in elastic members.
6. Learn to computation of slope and deflection in beams.

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

1. Evaluate stress - strain behavior and compute the stresses and deformations in various sections of elastic members.
2. Draw the variation of shear force and bending moment diagram for statically determinate beams for different loading conditions.
3. Analyze the distribution of shear stress and the flexural stress across the cross section of structural members.
4. Calculate angle of twist and shear stress developed in torsion and compute the critical load in columns.
5. Compute and locate principal stresses and planes using analytical or graphical method and strain energy stored in elastic members.
6. Evaluate slope and deflection in different beams and loading conditions.

Module	Contents	Hours	COs
I	**Simple Stresses and Strains:** Concept of stresses & strains and its types, Hook's law, Poisson's Ratio, factor of safety. Stress-strain curve for ductile and brittle materials, different Elastic modulus and relations, Elongation due to self-weight in uniform bar, Principle of superposition, Bars of uniform and Varying cross sections, composite sections. **Self-Learning:** Elongation of tapered bars and temperature stresses.	8	1

II	**Shear Force and Bending Moment in Beams:** Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying Loads, couple and their combination. **Self-Learning:** Prepare a chart showing SFD & BMD for simply supported and cantilever beam for various loading conditions.	8	2
III	**Shear and Bending stresses in beams:** Concept of shear stress in beams, Discussion of shear stress formula and shear stress distribution across various sections like rectangular, 'H', 'I' and 'T' sections. **Concept of Theory of pure bending, its assumptions,** Flexure formula for straight beam, simple problemsinvolving application of Flexure formula, section modulus, moment of resistance. **Self-Learning**: Bending stresses in flitched beam	10	3
IV	**Torsion in Shafts & Columns:** Concept of Pure torsion, solid and hollow circular shaft subjected to pure torsion, shear stress distribution in shafts and power transmitted by circular shafts. **Buckling of Columns:** concept of buckling, effective length, Assumptions, derivations of Euler's Buckling load for columns for different end conditions, Limitations of Euler's theory and Rankin's formula. **Self-Learning**: Prepare 3D models of different solid and hollow circular cross sections of shafts and find their cross sectional area, Ixx, Iyy and Izz.	8	4
V	**Principal planes and stresses & Strain Energy:** Concept of Principal planes and principal stresses, maximum Shear stress, stress determination by analyticalor Graphical method (using Mohr's circle). **Strain energy** due to axial force, impact loads in columns and due to torsion of Shaft. **Self-Learning**: Draw typical stress transformation cases of Mohr's circle using drawing sheet.	6	5
VI	**Slope and Deflection in Beams:** Concept of Slope and Deflection in Beams, Macaulay's Method for slope and deflection in Simply supported and Cantilever Beams subjected to point loads and UDL. **Self-Learning**: slope and deflection in Simply supported and Cantilever Beams for couple moments.	5	6

Exp. No.	List of Experiments	CO Mapping
1	Compression Test on Concrete cube	CO1
2	Compression Test on Timber	CO1
3	Compression Test on Brick.	CO1
4	Tension test on mild steel and HYSD bars.	CO1
5	Shear tests on different materials.	CO2

6	Bending test on Wood specimen one point or two-point loading and verify the flexural formula.	CO3
7	Impact test on different metals by Izod and Charpy method.	CO4
8	Using Torsion Testing Machine, verify the torsion equation, find different Moduli of a material.	CO4
9	Hardness test on different metals by Brinell and Rockwell test.	CO5
10	Flexural strength on flooring and roofing tiles.	CO6

Evaluation Scheme and Assessment:

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

1. CA should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15marks) examination will be conducted.

Reference Books:

1. Timoshenko and Young, "Elements of Strength of Materials" Affiliated EastWest Press.
2. Beer & Johnston, "Mechanics of Materials", TATA McGraw Hill.
3. James M. Gere, "Mechanics of Materials" - (5th Edition), Thomson Learning.
4. Strength of Materials: G.H. Ryder, Mc-Millan.
5. Strength of Materials: William A. Nash and Nillanjan Mallick, Mc-Graw Hill Book Co.

Text Books:

1. Strength of Materials: Basavarajaiah and Mahadevappa, Publishers, University press, Hyderabad India 3rd Edition 2010.
2. Strength of Materials: R S Khurmi & N Khurmi, S Chand Publishers, New Delhi.
3. Strength of Material: S.S.Bhavikatti, 2nd Edition Vikas Publications, New Delhi 2006.
4. Strength of Materials: S. Ramamrutham, Dhanpatrai Publishers.
5. Strength of Materials: R.K. Rajput, S. Chand Publications.

6. Strength of Materials (Mechanics of Materials): R.S. Lehri and A.S. Lehri, S.K. Kataria Publishers, New Delhi
7. Strength of Materials: S.S. Rattan, Tata Mc-Graw Hill, New Delhi.
8. Strength of Materials: M D Dayal, 6th Eddition.

Useful Links

1. https://www.youtube.com/watch?v=_DH3546mSCM.
2. https://archive.nptel.ac.in/courses/105/105/105105108/
3. https://www.youtube.com/watch?v=_DH3546mSCM
4. https://www.youtube.com/watch?v=EyIEenmUUfU
5. https://www.youtube.com/watch?v=f08Y39UiC-o
6. https://www.youtube.com/watch?v=MvBqCeZllpQ
7. https://www.youtube.com/watch?v=GUOKSExdjq8
8. https://www.bing.com/videos/riverview/relatedvideo?&q=Principal+planes+and+stresses&&mid=35465CE0A9261E7A52D435465CE0A9261E7A52D4&&FORM=VRDGAR.

Building Planning and Computer Aided Civil Engineering Drawings

Semester: III			Term: ODD				Course Code: 24CEPCC305					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted				IAE-1	IAE-2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr	Total Credit						
-	-	4	-	-	2	2	-	-	-	50	50	100

IAE: Internal Assessment Examination; ESE: End Semester Examination; TW: Term Work

Course Objectives:

1. To understand the principle of planning for residential & Public building
2. To understand Principle of Planning for differently abled publics
3. To understand the regulations as per National Building Code
4. To identify the functional requirements and building rules
5. To understand the sketches and working drawings
6. To understand Heating Ventilation and Air Conditioning

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

1. Understand building rules, regulation and byelaws, Building codes
2. Implement principles of planning of buildings
3. Design and draw various constructional drawing of the buildings.
4. Plan various building services.
5. Examine a design critically and with understanding of CAD - The student learns to interpret drawings, develop parametric designs and to produce designs using a combination of 2D and 3D software.
6. Communicate and transform a design concept graphically/ visually

Module	Contents	Hours
I	**Principles of Residential and Public Buildings:** **Theory Content:** Recommendation of National building code., Green building, Introduction-Benefits, National priorities, rating system, check list, Site selection and planning, Water efficiency, Energy efficiency, Materials, Indoor environmental quality, Innovation and design process. **Self-Learning:**Preparation of detailed constructional plan of a residential and public building	5

II	**Principle of Planning for differently abled publics**: Standardization and Contextualization of accessibility in built environment, Overview of accessibility codes (National and International Perspectives), Design for Inclusion : A holistic Approach (User centric approach to design, WINIT Model), Accessibility Elements of Built Environment in urban and rural Contexts (Kerb Ramps, Bollards, Level and gratings, Ramps, Gradients and other relevant elements) Principle of site planning and approaches for accessibility, Accessibility in public Sanitation System (Washroom typologies and Accessibility perspectives emergency evacuation systems and codes). Accessibility in public Sanitation System (Washroom typologies and Accessibility perspectives emergency evacuation systems and codes). **Drawings:** Drawing and identifying the symbols used for differently abled publics such as Kerb Ramps, Bollards, Level and gratings, Ramps, Gradients and other relevant elements, Washroom typologies. **Self-Learning:** Accessibility perspectives emergency evacuation Systems.	08
III	**Planning of Building:** Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window. Planning of building such as Residential building –Load bearing structure, RCC framed structure; Building for Education – school, college, Library; Building for health –Dispensary, Hospital; Industrial structure Building for entertainment-Theatre, club house, sports club. Another structure-Office, Hostel, Guest house. **Drawing:** 1. Preparation of front elevation, detailed sectional view, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window. 2. Concept of perspective drawing- one point, two-point, three point and uses. 3. Preparation of line plans of Building for Education – School, College and Library 4. Preparation of line plans of Building for health –Dispensary, Hospital; Industrial structure; Building for entertainment-Theatre, Club House, Sports Club; Other Structure- Office, Hostel, Guest house. 5. Preparation of line plans of Industrial structure; 6. Preparation of line plans of Building for entertainment-Theatre, Club House, Sports Club; **Self-Learning:** Preparation of line plans of Other Structure- Office, Hostel, Guest house.	21
IV	**Elevators:** Introduction, types of elevators. Essential features of lifts its size and requirement of minimum numbers, norms for safety doors, Operation and maintenance, Safety norms. Control systems, electrical requirement, and generator back-up, Escalators in Industry and in malls-multiplex. Design of Accessible Circulation System for differently abled publics. **Self-Learning:** With the help of AutoCAD software draw the elevators for various buildings.	8

V	**Heating Ventilation and Air Conditioning:** Ventilation, functional requirement, Heat balance system of ventilation, General rules and regulations in artificial ventilation system, Central air conditioning: - ducting and glass claddings. Operation and maintenance. **Self-Learning:** Using BIM prepare a sheet showing HVAC system	8
VI	**Fire Protection System:** Introduction, Fire protection, requirement of water quantity estimation. Systems of firefighting external and internal. Wet and dry risers, smoke alarm, Sprinkler system. Safety corridors in High-rise structures. **Self-Learning:** Design of emergency exits and emergency vehicle routes with fire protection Symbols	06
VII	**Building Management System:** Security Guard's Cabin, Parking Drawing: Prepare Security guard cabin and parking area for MNC Company (assuming 100 employees working in office, and 2 and 4wheeler are allowed) **Self-Learning:** : Prepare Security guard cabin and parking area for MNC Company (assuming50 employees working in office, and 2 and 4wheeler are allowed)	04

Evaluation Scheme and Assessment:

Continuous Assessment (CA):

1. CA should consist of all drawing as mentioned in syllabus
2. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
3. Total 50 Marks:

Practical Conduction and Evaluation	Attendance (Theory & Practical)
40 Marks	10 Marks

Oral & Practical Exam

Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted.

Reference Books:

1. Building Drawing with an Integrated Approach to Built Environment by M. G. Shah, C. M. Kale, S.Y. Patki (Tata McGraw-Hill Education)
2. Civil Engineering Drawing (including Architectural aspect) by M. Chakraborti (MonojitChakraborti Publications, Kolkata)
3. Planning and Designing Buildings by Y. S. Sane (Modern Publication House, Pune)
4. Building Drawing and Detailing by B.T.S. Prabhu, K.V. Paul and C. V. Vijayan (SPADES Publication, Calicut)

5. Building Planning by Gurucharan Singh (Standard Publishers & Distributors, New Delhi)
6. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117)
7. Croome, J. D. & Roberts, B. M., "AIR-CONDITIONING AND VENTILATION OF BUILDINGS VOL-1". Pergamon Press, (ISBN: 0080247792)
8. SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095)
9. N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990)

Text Books:

1. Scott Onstott, AutoCAD 2018 and AutoCAD LT 2018 Essentials, Wiley (2017), (ISBN: 9788126569298)
2. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).
3. Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805)

Course Title: Universal Human Values												
Semester: III			Term: ODD				Course Code: 24CSVEC301					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
2	1	-	2	1	-	3	10	10	30	25	-	75

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. To become more aware of themselves, and their surroundings (family, society, nature).
2. To become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. To become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
4. 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.

Course Outcomes:

At the end of the course students will be able:

1. To appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To practice plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with nature.

Module	Contents	Hours	Cos
I	**Introduction to Value Education**	**6**	
	• Understanding Value Education • Self-exploration as the Process for Value Education- Continuous Happiness and Prosperity – the Basic Human Aspirations • Right Understanding, Relationship and Physical Facility • Happiness and Prosperity – Current Scenario • Method to Fulfil the Basic Human Aspirations		CO1
II	**Harmony in the Human Being**	**6**	
	• Understanding Human being as the Co-existence of the Self and the Body • Distinguishing between the Needs of the Self and the Body • The Body as an Instrument of the Self • Understanding Harmony in the Self • Harmony of the Self with the Body • Programme to Ensure self-regulation and Health		CO1
III	**Harmony in the Family and Society**	**6**	
	• Harmony in the Family – the Basic Unit of Human Interaction • Values in Human-to-Human Relationship • 'Trust' – the Foundational Value in Relationship • 'Respect' – as the Right Evaluation • Understanding Harmony in the Society • Vision for the Universal Human Order		CO2
IV	**Harmony in the Nature (Existence)**	**5**	
	• Understanding Harmony in the Nature • Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature • Realizing Existence as Co-existence at All Levels • The Holistic Perception of Harmony in Existence		CO2
V	**Implications of the Holistic Understanding**	**4**	
	• Natural access acceptance of Human Values • Definitiveness of (Ethical) Human Conduct • A Basis for Humanistic Education, • Humanistic Constitution and Universal Human Order		CO3
VI	**Professional Ethics**	**3**	
	• Competence in Professional Ethics • Holistic Technologies, Production Systems and Management Models-Typical Case Studies • Strategies for Transition towards Value-based Life and **Profession**		CO3
	Total	**30**	

List of Tutorials

Sr. No.	Topic	Hrs.	COs
1	Sharing about oneself	1	CO1
2	Exploring human consciousness	1	CO1
3	Exploring natural acceptance	1	CO1
4	Exploring the difference of needs of self and body	1	CO1
5	Exploring sources of imagination in the self	1	CO1
6	Exploring harmony of self with the body	1	CO2
7	Exploring the feeling of trust	1	CO2
8	Exploring the feeling of respect	1	CO2
9	Exploring systems to fulfill human goal	1	CO2
10	Exploring the four orders of nature	1	CO2
11	Exploring coexistence in existence	1	CO3
12	Exploring ethical human conduct	1	CO3
13	Exploring humanistic models in education	1	CO3
14	Exploring steps of transition towards universal human order	1	CO3
	Total Hours	**14**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

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

Text Books:

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

Useful Links:

https://www.youtube.com/watch?v=PXSEpPFCn38

Bachelor of EngineeringIn Civil Engineering

Third Year
Semester – V (Rollover Batch)

REVISION: SJCEM RO – 24

Effective from Academic Year 2024-25

Board of Studies Approval:
Academic Council Approval:

Program Structure for Third Year V Semester, Civil Engineering

St. John College of Engineering and Management (Autonomous)

(With Effect from 2024-2025)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CEPCC501	PCC	Theory of Reinforced Concrete Structures	3	1	-	3	1	-	4
24CEPCC502	PCC	Applied Hydraulics	3	-	2	3	-	1	4
24CEPCC503	PCC	Geotechnical Engineering-I	3	-	2	3	-	1	4
24CEPCC504	PCC	Transportation Engineering	3	-	2	3	-	1	4
24CEPCE50X	PCE	Department Level Optional Course 1	3	-	-	3	-	-	3
24CEVSEC501	VSEC	Employability Enhancement Program – 5	-	-	6	-	-	3	3
24CEVSEC502	VSEC	Skill Based Lab with Mini Project	-	-	4	-	-	2	2
Total			**15**	**1**	**16**	**15**	**1**	**8**	**24**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE-I	IAE-II	ESE	TW	OR/PR	Total
24CEPCC501	PCC	Theory of Reinforced Concrete Structures	20	20	60	25	-	125
24CEPCC502	PCC	Applied Hydraulics	20	20	60	25	25	150
24CEPCC503	PCC	Geotechnical Engineering-I	20	20	60	25	25	150
24CEPCC504	PCC	Transportation Engineering	20	20	60	25	25	150
24CEPCE50X	PCE	Department Level Optional Course 1	20	20	60	25	-	125
24CEVSEC501	VSEC	Employability Enhancement Program – 5	-	-	-	50	-	50
24CEVSEC502	VSEC	Skill Based Lab with Mini Project	-	-	-	25	25	50
Total			**100**	**100**	**300**	**200**	**100**	**800**

THEORY OF REINFORCED CONCRETE STRUCTURES

Semester: V			**Term:** ODD				**Course Code:** 24CEPCC501					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE-1**	**IAE-2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	1	-	3	1	-	4	20	20	60	25	-	125

IAE: Internal Assessment Examination, ESE: End Semester Examination, TW: Term Work

Course Objectives- ***The objective of the content titled is to equip learners with the ability to:***

1. To develop clear understanding of design philosophy amongst the students for the design of reinforced concrete structure using working stress method (WSM) and limit state method (LSM).
2. To study various clauses of IS: 456-2000 and their significance in the RCC design.
3. To apply various concepts of LSM in the analysis and design of beams, slabs and columns.
4. To study the concept of Serviceability and Durability for deflection and crack width calculation in RCC structures.
5. To develop the concept of design using design charts and curves for columns subjected to axial load and moment.
6. To study the concept of reinforced concrete footing design subjected to axial load and moment.

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

1. Understand the fundamentals of WSM.
2. Understand the fundamentals of LSM.
3. Apply various clauses specified in IS: 456-2000 for designing structural members with safety and economy.
4. Understand the use of readymade design charts and curves from Special Publications of Bureau of Indian Standards.
5. Analyze and design various reinforced concrete elements such as beam, slab, column, footings using the concept of Limit State Method.
6. Analyze and design various reinforced concrete elements such as column, footingsusing the concept of Limit State Method

Module	Contents	Hrs	COs
I	**Working Stress Method:** Concept of reinforced concrete, Working Stress Method (WSM) of design for reinforced concrete, permissible stresses as per IS:456 2000. Concept of balanced, under reinforced and over reinforced sections. Analysis and design of singly reinforced and doubly reinforced Rectangular beams for Flexure. **Self-Learning**:- Stress- strain curve of concrete and steel, characteristics of concrete and steel reinforcement	05	CO-01
II	**Limit State Method:** Introduction to limit state method of design as per IS: 456-2000. Concepts of probability and reliability, characteristic load, characteristic strength, partial safety factors for loads and materials, introduction to various limit states of collapse. **Self-Learning**:- Introduction to limit state method of serviceability.	03	CO-02
III	**Limit State of Collapse: Flexure, Shear, Bond and Torsion:** Design of singly and doubly reinforced Rectangular and Flanged sections for flexure, shear and bond. **Self-Learning**:- Design of beams subjected due to torsion.	11	CO-03
IV	**Design of Slabs using Limit state method:** 1. Design of simply supported one-way slabs as per IS:456-2000. 2. Design of simply supported two-way slabs as per IS:456-2000. **Self-Learning**:- Detailed study on Slab Reinforcement detail.	12	CO-04
V	**Limit State of Collapse – Compression:** Limit state of collapse: compression for short and slender column. Introduction to Members subjected to combined axial anduniaxial as well as biaxial bending. **Self-Learning**:- Development of interactive curves and their use in column design.	08	CO-05
VI	**Design of Foundations:** 1. Design of Isolated square and rectangular footings subjected to axial load and moment. 2. Introduction to basic concepts of combined rectangular pad Footing, slab beam type footing. **Self-Learning**:- Raft foundation.	06	CO-06

Internal Assessment Examination: Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

1. CA should consist of 10 Tutorials
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Tutorials	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Reference Books:

1. Design of RCC structural Elements (RCC Vol-I): Bhavikatti, S. S., New Age International Publications.
2. Reinforced Concrete: Syal and Goel; Wheeler Publishers.
3. Reinforced Concrete Design: Pillai, S.U. and Menon, Devdas, Tata Mc-Graw Hill Publishing House, New Delhi.
4. Reinforced Concrete Design by S.N. Sinha, Tata Mc-Graw Hill Publishing House, New Delhi
5. Theory of Reinforced concrete structures by N. Subramanian, Oxford University Press.
6. RCC Design (WSM and LSM): Punmia, B. C., Jain, A. K., and Jain, Arun, K., Laxmi Publications.
7. Limit State Design of Reinforced Concrete (as per IS: 456-2000): Punmia, B. C., Jain, A. K., and Jain, Arun, K., Laxmi Publications.
8. Relevant IS Codes: BIS Publications, New Delhi.

Applied Hydraulics

Semester: V			Term: ODD				Course Code: 24CEPCC502					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	--	2	3	--	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination; ESE: End Semester Examination, TW: Term Work

Course Objectives:

1. To introduce the concept of impact of jets.
2. To study hydraulic machines like centrifugal pumps and turbines.
3. To study various Miscellaneous Hydraulic Machinery.
4. To study the uniform flow through open channels
5. To Design of most economical section.
6. To study the non-uniform flow through open channels

Course Outcomes:

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

1. Describe impact of jet on stationary, moving, hinged and series of plates also solve the numerical based on forces acting on it.
2. Distinguish various types of turbines, Characteristic curves and its components.
3. Analyze Centrifugal pumps by incorporating velocity triangle diagrams.
4. Know the working mechanism of various Hydraulic machines.
5. Identify the hydraulic behaviour of open channel flow and design the most economical section of channels.
6. Explain mathematical relationships for hydraulic jumps, surges, and critical, uniform, and gradually-varying flows.

Module	Contents	Hours	COs
I	**Impact of Jets:** Impulse momentum principle, Jet striking flat plates, stationary and moving vertical, inclined plates, hinged plates, curved vanes, series of plates and vanes mounted on wheel **Self-Learning**:- concept of velocity triangles.	08	CO-01

II	**Hydraulic Turbines:** General layout of hydro-electric plant, heads, efficiencies of turbine, classification, concept of velocity triangles working of Impulse Turbine (Pelton Wheel), Reaction Turbine, Francis Turbine, Kaplan Turbine, draft tube theory, specific speed, unit Quantities. **Self-Learning**:- Characteristic curves, Cavitation.	09	CO-02
III	**Centrifugal Pumps:** Work done, heads, efficiencies, Minimum speed: series parallel operation, Multistage pumps, concept of velocity triangles, specific speed, model testing, priming. **Self-Learning**:- characteristic curves, NPSH,cavitation.	06	CO-03
IV	**Miscellaneous Hydraulic Machinery**: Hydraulic Ram, Press, Accumulator, Intensifier, Crane and Lift.	05	CO-04
V	**Uniform Flow Through Open Channels:** Uniform Flow: Flow through open channel: Definition, types of channels, Prismatic, non-prismatic channels, Types of flows in channels, Uniform flow: steady flow and unsteady flow, laminar and turbulent flow, subcritical flow, supercritical flow, Chezy's formula, Manning's formula. **Self-Learning**:- hydraulically efficient channel cross-sections (most economical sections).	09	CO-05
VI	**Non-Uniform Flow Through Open Channels:** Concept of Specific energy and specific energy curve, Dimensionless specific energy discharge curve, applications of specific energy and Momentum principle to open channel flow, specific force. Gradually varied flow, equation for gradually varied flow, back water curve and afflux. **Self-Learning**:- Introduction to surface profiles, Hydraulic jump and standing wave.	08	CO-06

Exp. No.	List of Experiments	CO Mapping
1	Impact of jet, flat plate, inclined plate, curved vanes.	CO-01
2	Performance of Pelton turbine.	CO-02
3	Performance of Francis Turbine.	CO-02
4	Performance of Kaplan Turbine.	CO-02
5	Performance of Centrifugal pumps.	CO-03
6	Hydraulic Ram	CO-04
7	Chezy's roughness factor.	CO-05

8	Specific energy Curve	CO-05
9	Hydraulic Jump	CO-06
10	Calibration of Broad crested weir/Venturi flume.	CO-06

Evaluation Scheme and Assessment:

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

1. CA should consist of 10 experiments or 10 Tutorials (Which ever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15marks) examination will be conducted.

Reference Books:

1. Hydraulics and Fluid mechanics: Dr. P.M. Modi and Dr. S.M. Seth, Standard Book House, Delhi.
2. Theory and Application of Fluid Mechanics: K. Subramanian, Tata McGraw hill publishing company, New Delhi.
3. Fluid Mechanics: Dr. A.K Jain, Khanna Publishers.
4. Fluid Mechanics and Hydraulics: Dr. S.K. Ukarande, Ane's Books Pvt. Ltd. (Revised Edition

2012), ISBN 97893 8116 2538.

5. Fluid Mechanics and fluid pressure engineering: Dr. D.S. Kumar, F.K. Kataria and sons.
6. Fluid Mechanics: R.K. Bansal Laxmi Publications (P) Ltd.
7. Flow through open channels, K.G. Ranga Raju. (1993) : New Delhi : Tata McGrawHill, c1993.

Text Books:

1. Fluid Mechanics: Frank M. White, Tata Mc-Graw Hill International Edition.
2. Fluid Mechanics: Streeter White Bedford, Tata Mc-Graw International Edition.
3. Fluid Mechanics with Engineering Applications: R.L. Daugherty, J.B. Franzini, E.J.
4. Finnemore, Tata Mc-Graw Hill, New Delhi.
5. Hydraulics: James F. Cruise, Vijay P. Singh and Mohsen M. Sherif, CENGAGE Learning India (Pvt.) Ltd.
6. Introduction to Fluid Mechanics: Edward J. Shaughnessy, Jr, Ira M. Katz, James P. Schaffer. Oxford Higher Education.

Geotechnical Engineering-I

Semester: V			Term: ODD				Course Code: 24CEPCC503					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination; ESE: End Semester Examination, TW: Term Work

Course Objectives:

1. To study origin and mode of formation of soil as well as functional relationships among different unit weights, volumetric ratios, and water content.
2. To study clay mineralogy and plasticity characteristics of soils.
3. To comprehend particle size distribution and classification of soils as per IS code.
4. To study permeability and seepage flow of water through the soil.
5. To understand the concept of total stress, neutral stress and effective stress in soil
6. To understand compaction characteristics of soils as well as the techniques of soil exploration, assessing the subsoil conditions and engineering properties of various soil strata.

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

1. Explain the basic concepts of the physical and engineering properties of soil and derive the relationships among various unit weights & other parameters.
2. Comprehend clay mineralogy and plasticity behavior of clay.
3. Analyze grain size distribution of soil and classify the soil as per IS code.
4. Evaluate the coefficient of permeability of different types of soils and draw the flow net diagram to estimate seepage discharge.
5. Compute the effective stress and pore water pressure inside the soil mass under different geotechnical conditions.
6. Evaluate the compaction parameters in laboratory and field as well as understand the necessity and methods of soil exploration.

Module	Contents	Hours	COs
I	**Introduction to Geotechnical Engineering, Basic Definitions & Relationships** Definitions and scope of Geotechnical Engineering: Rocks, soil, origin & mode of formation and types of soil obtained, soil mechanics, rock mechanics, geotechnical engineering. Soil phase systems, volumetric ratios: void ratio, porosity, degree of saturation, air voids, air content. Weight-volume relationship: different unit weights, water content, specific gravity of soil solids, mass and absolute specific gravity. **Self-Learning**:- Functional relationships among different unit weights, volumetric ratios, and water content. Relative density, relative compaction. Different methods to determine water content, specific gravity and unit weight of soil.	07	01
II	**Clay Mineralogy and Plasticity Characteristics of Soils**: Explanation about clay minerals, e.g., Montmorillonite, Illite and Kaolinite; formation of clay minerals and their role in plastic behavior of soil. Definition of plasticity of soil, consistency of soil, definition & determination of liquid limit, plastic limit, shrinkage limit. Definitions of shrinkage parameters, plasticity index, liquidity index, consistency index, flow index, toughness index, activity, sensitivity and thixotropy of soil. **Self-Learning**:- Importance of consistency limits.	07	02
III	**Particle Size Distribution and Classification of Soils**: Wet & dry sieve analysis, Sedimentation analysis: Stoke's law, Hydrometer method of analysis, Limitation of sedimentation analysis. Particle size distribution curve/ gradation curve and its uses. Introduction to cohesive and cohesionless soil. Necessity of soil classification, Indian standard particle size classification. **Self-Learning**:- Indian standard soil classification system as per IS: 1498-1970, boundary classification.	06	03
IV	**Permeability of Soils & Seepage Analysis:** Types of soil water, definition of hydraulic head, hydraulic gradient, Darcy's law, validity of Darcy's law, permeability of soil. Determination of coefficient of permeability of soil in lab using constant head and variable head methods, factors affecting permeability of soil, effect of permeability on various properties of soil, determination of in-situ permeability with pumping out and pumping in tests. Permeability of stratified soil deposits. Definition of seepage and its importance for the analysis & design of hydraulic	09	04

	structures, graphical representation of seepage by flow net diagram, definition of flow line, equipotential line, flow channel, flow field, characteristics of flow net, use of flow net, phreatic line. **Self-Learning**:- Factor of safetyAgainst piping failure.		
V	**Effective Stress Principle**: Definition of geostatic stresses, total stress, neutral stress/ pore water pressure, effective stress. Effect of water table fluctuations, surcharge, capillary action, seepage pressure on effective Stress; quick sand condition.	08	05
VI	**Compaction of Soil & Soil Exploration**: Theory of compaction, determination of optimum moisture content (OMC) & maximum dry density (MDD) in laboratory by conducting the light and heavy Compaction tests. Factors affecting the compaction, effect of Compaction on properties of soil, soil structure, placement water content, relative compaction, Proctor needle method for compaction. Necessity of soil exploration, methods of soil investigation, methods of boring, disturbed and undisturbed soil samples, soil sampling and samplers, number and spacing of bore holes, depth of bore holes. Penetrometer tests: SPT, SCPT and DCPT. **Self-learning:** Representation of data with Borehole logs.	08	06

Exp. No.	List of Experiments	CO Mapping
1	Determination of natural moisture content of soil using oven drying method	CO-01
2	Specific gravity of soil grains by density bottle method or Pycnometer method	CO-01
3	Field density using core cutter method	CO-02
4	Field density using sand replacement method	CO-02
5	Determination of liquid (Casagrande method), plastic and shrinkage limits	CO-02
6	Field identification of fine-grained soils	CO-03
7	Grain size distribution of coarse-grained portions (gravel and sand) of soil by sieve analysis	CO-03
8	Determination of co-efficient of permeability using constant head method	CO-04
9	Determination of co-efficient of permeability using falling head method	CO-04
10	Determine Pore water pressure of given soil	CO-05
11	Compaction test, IS light compaction test/ Standard Proctor test	CO-06
12	Compaction test, IS heavy compaction test/ Modified Proctor test	CO-06

13	Standard Penetration Test	CO-06

Evaluation Scheme and Assessment:

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

1. CA should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15marks) examination will be conducted.

Recommended Books:

1. Basic and Applied Soil Mechanics: Gopal Ranjan, A S R Rao; New Age International Publishers.
2. Soil Mechanics and Foundation Engineering: V. N. S. Murthy; CBS Publishers & Distributors
3. Soil Mechanics and Foundation Engineering: K. R. Arora; Standard Publishers and Distributors, New Delhi.
4. Soil Mechanics and Foundations: B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain; Laxmi Publications (P) LTD., New Delhi
5. Geotechnical Engineering: C. Venkatramaiah; New Age International Private Limited
6. Fundamentals of Soil Engineering: D. W. Taylor; John Wiley & Sons.

Reference Books:

1 An Introduction to Geotechnical Engineering: Robert D. Holtz, William D. Kovacs; Prentice-Hall, New Jersey

2 Soil Mechanics: R. F. Craig; Spon Press, Taylor and Fransis Group

3 Soil Mechanics: T. W. Lambe, R. V. Whitman; John Wiley & Sons

4 Relevant Indian Standard Specifications Codes, BIS Publications, New Delhi

5 Soil Mechanics in Engineering Practice: Karl Terzaghi, Ralph B Peck, Gholamreza Mesri; John Wiley & Sons

Transportation Engineering

Semester: V			Term: ODD				Course Code: 24CEPCC504					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination; ESE: End Semester Examination, TW: Term Work

Course Objectives:

1. To understand the planning and developments of highways
2. To carry out design of geometric elements of Highways.
3. To study various traffic studies and to understand elements of Traffic Engineering for efficient planning and control.
4. To study Requirements of Highway materials and to design Rigid and flexible pavements using IRC codes.
5. To study methods of construction of Rigid and Flexible pavements and to study the drainage of highways.
6. To design the overlay on basis of pavement evaluation and to carry out failure identification on rigid and flexible pavements.

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

1. Compare various modes of transportation and understand planning and development of highways
2. Understand requirements of alignments and carry out design of geometrical elements of highways.
3. Carry out different traffic studies and analyze basic parameters of traffic engineering for efficient planning and control of traffic.
4. Design the flexible and rigid pavement as per relevant IRC codes.
5. carry out Construction of different types of pavements and planning of highwaydrainage.
6. Carry out structural and functional evaluation of pavement, identify the failures and designthe over

Module	Contents	Hours	Cos
I	**Highway Development and planning**: Introduction to Highway Engineering, Comparison of various modes of transportation (Roadways, Railways, Airways and Waterways). History of road developments, Road Development in India. Classifications of roads, Planning Surveys, Road Alignment, Requirements of an ideal alignment, Factors affecting road alignment, Steps involved in Preparation of detailed new and old alignment and report preparation. **Self-learning:** Salient features of ongoing major road projects in the country	10	01
II	**Geometric Design of Highways:** Importance, Factors controlling the design of Geometric elements, Cross Section Elements- Right of way and width consideration, roadway, shoulders, kerbs, traffic barriers, camber, medians, Facilities for pedestrians, buses and trucks. Sight distances-Types, Factors affecting and measurements. Horizontal alignment and super elevation. Vertical alignment - Gradient, Types of Vertical curves, Design and length Computation. **Self-learning:** Measurement of extra widening and super-elevation	10	02
III	**Traffic Engineering:** Introduction to various traffic studies. Speed study: methods to determine speed, types of speed (Spot speed, Design speed, Upper & lower limit speeds, Mean - Median and Modal speed); Traffic Volume study (flow): Definition, AADT, ADT, Design volume, methods of determining traffic volume. Traffic density: Definition, importance; Introduction to Relationship between Speed, density and volume. Capacity: Q-K-V curve, Different types and factors affecting capacity, Concept of PCU and LOS; Introduction to traffic control devices Traffic signs, signals (no design), road marking. Different types of Intersections- At-grades and Grade Separated; **Self-learning:** Grade separated interchanges; rotary Intersection.	06	03
IV	**Pavement Material and Design** Types of pavements, comparison of flexible and rigid pavements, Requirements of pavement materials, Soil: requirement of soils as subgrade material, CBR test. Aggregate: Requirements of aggregate as Pavement material, Tests on aggregate Bitumen: Requirements of bitumen as pavement material test on bitumen with specified values, variants of bitumen (Modified bitumen) and its uses. Introduction to Bituminous mix design using Marshall Stability test. Flexible pavement design: IRC: 37–2018. Rigid pavement design: IRC: 58 – 2015	08	04

	Self-learning: IRC specified values.		

V	**Pavement Construction and Drainage**: Construction of different types of roads: water bound macadam (WBM) road, WMM, bituminous pavements, cement concrete pavement. And joint (As per IRC, MORTH specifications) jointed reinforced, continuously reinforced; fiber reinforced; roller compacted concrete pavements; Highway drainage: Necessity/ Significance, mode of ingress of water in highway structure, **Self-learning:** Different methods of drainage- surface and subsurface Drainage.	06	05
VI	**Pavement Evaluation, Failures and Maintenance**: Evaluation of pavement, Structural and functional evaluation, methods of structural evaluation methods of functional evaluation; Distress / failure in Rigid and flexible pavement, reasons and measures; Strengthening of existing pavement, Overlay and its types, **Self-learning:** design of overlay (Benkelman beam method)	06	06

Exp No	Detailed Content	CO Mapping
1	Impact test on aggregate	CO-04
2	Los Angeles abrasion test on aggregate	CO-04
3	Crushing strength of aggregate	CO-04
4	Combined index of aggregate	CO-04
5	Traffic Volume study (flow)	CO-03
6	CBR Test	CO-04
7	Penetration Test on Bitumen.	CO-04
8	Viscosity Test on Bitumen.	CO-04
9	Softening Point Test on Bitumen	CO-04
10	Ductility Test on Bitumen	CO-04
11	Site Visit for Pavement Construction, and Drainage (Rigid & Flexible)	CO-05 & 06
12	Multi-Modal Transportation Challenge: A Design and Build Activity This activity combines elements of transportation engineering for roadways, railways, airports, and waterways, allowing participants to explore the Different considerations for each mode.	CO-1
13	Onsite measurement of super elevation and extra widening of pavement.	CO-2

Evaluation Scheme and Assessment:

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Term Work:

1. Term work should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15marks) examination will be conducted.

Recommended Books:

1. A Course of Railway Engineering: Saxena, S. C. and Arora, S. P.; Dhanpat Rai Sons, New Delhi.
2. Airport Planning Design: Khanna, S.K., Arora, M.G.and Jain, J.J.; Nemchand Bros.,
3. Roorkee.
4. Docks and Harbour Engineering: Bindra, S. P.; Dhanpat Rai and Sons,New Delhi.
5. Highway Engineering: Khanna, S.K. and Justo, C. E. G.; Nem Chand and Bros., Roorkee.
6. Principles, Practice and Design of Highway Engineering (Including Airport
7. Engineering)" Sharma, S.K.; S. Chand and Company Pvt. Ltd., New Delhi.
8. Highway Material and Pavement Testing: Dr. S. K. Khanna, Dr. C. E. G. Justo and Dr. A. Veeraragavan. Nem Chand and Bros., Roorkee, India.

Reference Books:

1. Indian Railway Track: Agarwal, M. M., Suchdeva Press New Delhi.
2. Planning Design of Airport: Horonjeff Mckelrey, Tata Mc-Graw Hill India Publishing House,

New Delhi.
3. Design and Construction of Ports and Marine Structures: Quinn, A. D., Tata Mc-Graw Hill India Publishing House.
4. Transportation Engineering and Planning: C.S. Papacostas and P.D. Prevedouros; Prentice Hall India Learning Pvt. Ltd., New Delhi.
5. Principles of Transportation Engineering: Chakrabory, Partha and Das, Animesh; Prentice Hall India Learning Pvt. Ltd., New Delhi.
6. Transportation Engineering: Khisty, C.J. and Lall, Kent, B.; Prentice Hall India Learning Pvt. Ltd., New Delhi.
7. Traffic Engineering and Transport Planning: Kadiyali, L.R., Khanna Publishers, Delhi.
8. Principles and Practice of Highway Engineering: Kadiyali, L. R.; Khanna Publsihers, Delhi.
9. Relevant specifications of MORTH and relevant IRC codes.

Building Services & Repairs

Semester: V			Term: ODD				Course Code: 24CEPCE501					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted									
Th	Tu	Pr	Th	Tu	Pr	Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
3	-	-	3	-	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination; ESE: End Semester Examination; TW: Term Work

Course Objectives:

1. To understand the concepts of mechanical systems such as lifts, escalators, HVAC systems, pumps & their applications.
2. To understand design concepts of electrical system, safety and illumination fundamentals.
3. To get familiar with the plumbing system and services in buildings related to water supply, drainage, gas supply and firefighting installations.
4. To learn about causes of distress of concrete structures and learn various instrumental testing methods for Condition assessment & evaluation of structure and assess the extent of repairs.
5. To acquire the knowledge of repair materials and repair methodologies for rehabilitation of RCC structures.
6. To learn implementing repair process and to follow safety during construction work.

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

1. Apply the knowledge of working & installation of mechanical utility services in buildings.
2. Understand the electrical supply lines, materials, safety devices and illumination systems used in buildings.
3. Investigate and learn operations and adopt appropriate materials in plumbing systems & integrate the same into the building projects.
4. Assess the structural health of the buildings & adopt repair strategy to the damaged structures.
5. Implement the right methods and materials for repairing the concrete structures and also decide the sequence of operations.
6. Create and understand proper documentation process and adopt practices for safety for protection of men and materials on the repair site.

Module	Contents	Hours	COs
I	**Mechanical systems:** Lifts/elevators, escalators, conveyors: their components, capacity and principles of working, common problems. Motors, Generators, Pumps, HVAC Systems - Heating systems, Cooling Systems, Packaged HVAC, types, capacity. **Self-learning:** Components and their principles of working, common problems.	05	1

II	**Electrical systems & Illumination in Buildings:** Electrical grids and supply system: Layout of substations Transformers & switch gears, Main & distribution boards, electrical systems in buildings, Single / Three phase supply, ISI specifications, electrical load, electrical layout plan in a building, Types of wires, wiring system & their choice, Solar energy, CCTV, LAN. Protective devices in electrical installation: Earthing for safety, Types of Earthing, fuses, circuit breakers, lightening arrester. **Principles of Illumination Design:** Visual task, Factors affecting visual task, Luminous flux, candela, solid angle illumination, utilization factor. Modern theory of light & colour: Synthesis of Light, Additive & Subtractive synthesis of colour, classification of lighting, artificial lights sources, spectral energy distribution, luminous efficiency, colour temperature, colour rendering. **Level of illumination:** Lighting for stores, offices, school, hospitals and house lighting. **Self-Learning**: elementary idea of special features required and minimum level of illumination required in buildings.	10	2
III	**Plumbing Systems in Building:** Water Distribution system: Material for service pipes, service connection, size of service pipe, Water meter, valves and storage tanks, water requirement for domestic use and firefighting. **Drainage system:** Pipe and traps, system of plumbing, house drainage plans, Chambers- gradient and spacing, manholes, septic tanks and soak pit, Introduction to rain water harvesting system. **Self-Learning**: **Other plumbing systems:** Fire safety, fire-fighting installations, types and purpose, piped gas supply systems, AC ducting.	07	3
IV	**Deterioration of Concrete Structures & Condition assessment:** Durability & Cause of deterioration of concrete structures: effects of climate, moisture, temperature, chemical, wear, erosion & loading on serviceability & durability. Design errors & construction errors, causes of seepage & leakage in concrete structures, formation of cracks including those due to corrosion. **Condition Survey, Evaluation & Damage Assessment:** Structural	08	4

	audit and bye laws. Diagnostic methods & analysis. Destructive, semi-destructive and non-destructive methods: core test, carbonation test, chloride test, petrography, corrosion analysis, cover meter test, rebound hammer test, ultrasonic pulse velocity test, and crack measurement techniques. **Self-Learning**: Concrete endoscopy & thermal imaging, pull- off test & pull-out test.		
V	**Repair Materials & Methodologies For Repairs:** Repair analysis, Repair materials: and their desired properties, Polymer modified mortar/ concrete, micro concrete, bonding chemicals, protective materials and their properties for moisture barrier systems, water-proofing of concrete structures, Systems like integral, crystalline, coatings, membranes, joints sealants, crack repair fillers, corrosion resistant steels, Pre-packed zinc sacrificial anode, Snap-On zinc mesh anode CP system, corrosion inhibitors, rust solvents. **Repair methodologies:** Crack and patch repair, Injection grouting, surface coatings, column jacketing, guniting, shotcrete, Ferroconcrete. **Self-Learning**: FRP, Carbon fiber wrapping, methods of rebar corrosion protection, cathodic protection.	08	5
VI	**Repair Process Implementation and Safety During Repairs:** Legal Documentation and Records: Estimates of repair work, procedure and flow chart for repairs, Bill of quantities, Tendering, Work order, Agreement and Contract, Measurement book, bills, security deposits, role of PMC. **Safety during Repairs:** Causes of accidents, safety signs, barricading, insurance. **Self-Learning**: Temporary Support structures such as, formwork, shuttering, centring, staging and scaffolding.	07	6

Evaluation Scheme and Assessment:

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

Tutorials	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Guide to Concrete Repair and Protection, HB84-2006, A joint publication of Australia Concrete Repair Association, CSIRO and Standards Australia
2. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG (Works), CPWD, Government of India (Nirman Bhawan)
3. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center.
4. Management of Deteriorating Concrete Structures: George Somerville, Taylor and Francis publication
5. Concrete Building Pathology: Susan Macdonald, Blackwell Publishing.
6. Testing of Concrete in Structures: John H. Bungey, Stephen G. Millard and Michael G. Grantham, Taylor and Francis Publication.
7. Durability of concrete and Cement Composites: Page, C.L.and Page, M.M., Woodhead Publishers
8. Fire Safety in Building: V. K. Jain, New Age International Publication, Delhi
9. MEP systems & Repairs of Buildings: A.S. Radke, Published by Synergy Knowledgeware.

Text Books:

1. Heat Pumps and Electric Heating: E. R. Ambrose, John and Wiley and Sons, Inc., New York, 1968
2. Handbook for Building Engineers in Metric Systems, NBC, New Delhi, 1968.
3. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.
4. The Lighting of Buildings: R. G. Hopkinson and J. D. Kay, Faber and Faber, London, 1969.
5. Building Construction: Dr. B. C. Punmia, Ashok K Jain, A.K Jain

6. Construction Engineering and Management: S. Seetharaman, Umesh Publications, Delhi.
7. Water supply and Sanitory Installations: A. C. Panchdhari, New Age International Publication, Delhi
8. Concrete Repair and Maintenance: Peter H. Emmons and Gajanan M. Sabnis, Galgotia Publication
9. Repairs and Rehabilitation-Compilation from Indian Concrete Journal-ACC Publication.

Sustainable Building Materials

Semester: V			Term: ODD				Course Code: 24CEPCE502					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted									
Th	Tu	Pr	Th	Tu	Pr	Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
3	-	-	3	-	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination; ESE: End Semester Examination; TW: Term Work

Course Objectives:

1. To have more awareness among students about sustainability.
2. To understand environmental issues due to building materials and the energy consumption in manufacturing building materials.
3. To study the alternative masonry unit and mortar for sustainable practices.
4. To know the importance of cement reduction and replacements for a sustainable development.
5. To understand the alternative building technologies which are followed in construction.
6. To have cognizance of alternative roofing systems in practice.

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

1. Explain sustainable practices by utilizing engineering practices.
2. Able to understand different types of environmental problems and their sustainable solution.
3. Suggest appropriate type of masonry unit and mortar for civil engineering constructions.
4. Analyze different alternative building materials for construction.
5. Suggest suitable alternative building technologies for sustainable development.
6. Propose different roofing systems and use of waste materials in construction industry.

Module	Contents	Hours	COs
I	**Sustainability** **Introduction:** Need and concept of sustainability, Social Environmental and economic sustainability concepts, Sustainable development, Nexus between technology and Development, Challenges for sustainable development and Fundamentals of sustainability **Global Environmental issue:** Resource degradation, ozone layer Depletion Climate change, Carbon cycle, Factors affecting Carbon credits and carbon trading, carbon foot Print, Carbon sequestration-carbon capture and storage (CCS). **Self-Learning**: Environment legislation in India-water act and air act.	08	01

II	**Energy In Building Materials** Embodied energy and life cycle energy, Calculation of embodied energy in wall, Environmental issues concerned to building materials, Global warming and construction industry. Environment friendly and cost-effective building technologies. Requirements for building of different climatic regions. Traditional building methods and vernacular architecture Green buildings, Intelligent buildings, green materials, green building ratings-IGBC & LEED. **Self-Learning:** Renewable and nonrenewable energy sources.	07	02
III	**Elements of Structural Masonry** Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks, fly ash bricks and hollow clay blocks, Concrete Blocks, Stabilized blocks: mud blocks, steam cured blocks, Fal-G Blocks stone masonry block. **Masonry Mortars:** Mortars, Cementitious materials: Lime, OPC, PPC, Masonry cement, Lime pozzolana (LP) cement. Sand: natural and manufactured, Classification of mortar as per BIS, Types of mortar, **Self-Learning**: Properties and requirements of mortar, Selection of mortar.	07	03
IV	**Cementitious and Supplementary Cementitious Materials and their Characterization:** Lime, Lime pozzolana cements, Pozzolana: Surkhi, Fly ash, IS (3812) (Type C and F), GGBFS, Silica Fumes, Metakaolin, RHA, Composite cements and its types, IS (16415:2015), Magnesia based cements, Calcium sulfo- cement, Alkali activated, cement (Type 1 and Type II), Geopolymers. Composition,Properties and uses. **Membrane curing:** wax and resin based, self-curing compound: Polymer and polyethylene glycol, Water reducing admixtures. **Self-Learning**: use of treated domesticeffluent (TDE) for mixing and curing	07	04

V	**Alternate Building Technologies:** Fiber reinforced cement composites: Matrix materials, reinforcing Materials, Applications Fiber reinforced polymer composites: Matrix materials, types of polymers used and applications Ferrocement and ferroconcrete building components: Materials, Construction methods, Mechanical properties, Applications. **Self-Learning**: Nanotechnology for sustainable construction.	08	05
VI	**Alternate Building Materials and Roofing Systems:** Building materials from agro and industrial waste: Typical agro- waste and biomass resources, Use of industrial waste: Fly ash, Blast furnace slag, Iron ore tailings, Gold mine tailings Granite and marble polishing fines, demolished building waste Concepts in roofing alternatives, Types of roof, Roof as a structural system, Cost reduction through construction process efficiency Filler slab roofs, Composite beam and panel roofs, construction. Details and roof assembly. **Self-Learning**: Masonry domes and vaults: Relevance, analysis and design, Barrel vault.	08	06

Evaluation Scheme and Assessment: Internal Assessment Examination: Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination: End Semester exam of 60 Marks will be conducted based on entire syllabus.

Term Work:

1. Term work should consist of 10 experiments or 10 Tutorials (Which ever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Tutorials	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Oral & Practical Exam: Based on the entire syllabus, oral (10 marks) & practical/implementation (15marks) examination will be conducted.

Reference Books:

1. Alternative Building Materials and Technologies by KS Jagadish, BV Venkatraman Reddy and KS Nanjunda Rao, New Age International publications.
2. Sustainability Engineering: Concepts, Design and Case studies by Allen D.T, and Shonnard D.R , Prentice Hall.
3. Sustainability Engineering: Concepts, Design and Case studies by Bradley A.S; Adebayo A.O, and Mario P., Cengage learning
4. Sustainability of construction materials by Jamal M Khatib, Woodhead publishing limited.
5. Renewable energy sources by Twidell J.W and Weir A.D, English Language Book Society (ELBS)

Text Books:

1. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy efficiency Publications—Rating system, TERI Publications – GRIHA Rating system.
2. Structural Masonry by Arnold W Hendry, Macmillan Publishers
3. Systems Analysis for Sustainable Engineering: Theory and Application by Ni bin Chang, Mc Graw Hill Professional
4. NPTEL course on sustainable materials and green building

Advanced Concrete Technology

Semester: V			Term: ODD				Course Code: 24CEPCE503					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted				IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr	Total Credit						
03	-	-	03	-	-	03	20	20	60	25	-	125

IAE: Internal Assessment Examination; ESE: End Semester Examination; TW: Term Work

Course Objectives:

1. To understand the various properties and tests of materials used in concrete along with the rheology of fresh concrete.
2. To study the different procedures for testing hardened concrete, its compositions and quality of in place concrete.
3. To understand the concept of durability and cracking in concrete. Also understand the significance and parameters of concreting under extreme environment and conditions.
4. To understand the concept and optimization of the mix design of concrete by various codes.
5. To study the various constituents, properties, significance and applications of special concrete.
6. To study the quality of concrete and check the acceptance criteria.

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

1. Use the various concrete materials and demonstrate the fresh properties of concrete.
2. Perform different testing methods of concrete.
3. Describe the durability of concrete and apply the knowledge of durability in extreme weather concreting.
4. Design the concrete mix for field application by different methods.
5. Explain the various properties of special concrete.
6. Discuss the quality of concrete and explain the acceptance criteria.

Module	Contents	Hours	COs

I	**Constituents and Properties of Concrete** **Introduction of cement and water:** Chemical composition of OPC, hydration, cement testing, water requirement for hydration, water quality for concrete. **Aggregates:** Types of aggregate, required characteristics of aggregates for concrete, introduction to gradation of aggregates. **Chemical admixture:** Introduction to accelerators, retarders, plasticizers, super plasticizers, water proofers, miscellaneous admixtures. **Mineral admixture:** Introduction, composition of mineral admixture, fly ash and its type, silica fume, ground granulated blast furnace slag and others. Effects of mineral admixture on fresh and hardened concrete properties. **Properties of fresh concrete:** Introduction to properties of fresh concrete, w/c ratio, gel space ratio, pumping of concrete. **Rheological models of fresh concrete:** Introduction, simple flow test, factors Affecting rheological properties of concrete. **Self-Learning**: effect of rheological properties on different types of concrete.	10	01
II	**Testing of Concrete** **Introduction to testing of hardened concrete** - compression, tension, and flexure. Methods of testing (destructive, semi destructive, non-destructive) Properties of hardened concrete: Factors influencing strength, importance of compression testing, tensile strength of concrete (split and flexural), relationship between compressive and tensile strength. **Advanced non-destructive evaluation:** Ground penetration radar, probe test penetration, pull out/off, break off method, stress wave propagation method, affecting rheological properties of concrete. **Self-Learning**: effect of rheological properties on different types of concrete. electrical / magnetic methods, infrared thermography, and core test.	08	02
III	**Durability of Concrete** **Introduction to durability and permeability:** Transport mechanism of fluids and gases in concrete, role of w/c and admixture on durability. **Corrosion and carbonation:** Introduction to corrosion of reinforcement in concrete, factors influencing corrosion, damages preventive measures of corrosion, introduction and measurement of depth of carbonation. **Concrete structures in special environment**: Frost action, fire or high temperature, chemical attack and aggressive environment (sulphate attack, chloride attack, acid attack in sewers, sea water attack), alkali aggregate reaction (alkali silica and carbonate reaction). **Self-Learning**: **Concreting under extreme weather:** Hot and cold weather concreting, underwater concreting.	06	03

IV	**Concrete Mixture Design: Design of concrete mixes by IS 10262 (latest edition) Method** – with and without fly ash, super plasticizer, effect of pumping of concrete on mixture design. **Design of concrete mixes by American Concrete Institute (ACI) Method** – Air and non-air entrained concrete. Design of concrete mixes by Department of Environment (DoE) Method. Design of concrete mixes by Road note 4 Method. **Self-Learning**: Design of high strength concrete mixes using ACI 211.4R - 93 Method.	07	04
V	**Special Concretes** **Light weight concrete and ultra-light weight concrete:** Types and properties of light weight aggregates, factors influencing the strength and density of light weight aggregate concrete, properties of light weight aggregate concrete. Introduction to other light weight concrete – Cellular and foamed concrete. **High performance concrete:** Methods for achieving high performance concrete, requirements for high performance characteristics, material selection, advantages and applications. **Self-compacting concrete (SCC):** Materials for SCC, comparison of traditional and SCC constituents, requirements for SCC, initial mix compositions, production and placing of SCC, fresh concrete tests for SCC. **Fiber Reinforced Concrete (FRC):** Study of different fibers (metallic fiber, polymeric fibers, carbon fibers, glass fibers, naturally occurring fibers) in concrete with respect to volume fraction, orientation and aspect ratio, physical and mechanical properties - steel and polypropylene fiber reinforced concrete. Applications of steel and polypropylene fibers reinforced concrete. **Self-Learning**: **Introduction to other special concrete** – Vacuum concrete, waste material-based concrete, shotcrete, roller compacted, mass concrete.	11 03	05 06
VI	**Quality Control (QC)** Introduction: Statistical QC, quality factors, control charts. Acceptance criteria according to Indian standards: **Self-Learning**: Strength of concrete (site and laboratory)	03	06

Evaluation Scheme and Assessment: Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Term Work:

1. Term work should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Tutorials	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Reference Books:

1. Fibre Reinforced Cementitious Composites: Arnon Bentur and Sidney Mindess,
2. Modern Concrete Technology Series, Tylor and Francis.
3. Concrete- Microstructures, Properties and Materials: P. Kumar Mehta and Paulo J. M.
4. Monteiro, Indian Edition, Indian Concrete Institute, Chennai, 1999
5. Special Publication of ACI on Polymer concrete and FRC.
6. Concrete Technology: D.F. Orchardi, Wiley, 1962.

Text Books:

1. Concrete Technology: A. R. Shanthakumar, Oxford University Press, New Delhi, 2007.
2. Concrete Technology Theory and Practice: Shetty M.S., S. Chand.
3. Properties of concrete: Neville, Isaac Pitman, London.
4. Concrete Technology: Gambhir M.L., Tata McGraw Hill, New Delhi.
5. Concrete Technology: Neville A.M. & Brooks. J. J., ELBS-Longman, Pearson Education Ltd.
6. Relevant I.S. codes: Bureau of Indian standard and ACI code.
7. Design of concrete mixes by N Krishna Raju (Latest Edition),
8. CBS Publishers and Distributers Pvt. Ltd.

Useful Links

1. www.theconcreteportal.com

Skill Based Lab with Mini Project

Semester: V			Term: ODD				Course Code: 24CEPCE503					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted				IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr	Total Credit						
-	-	4	-	-	2	2	-	-	-	50	25	75

IAE: Internal Assessment Examination; ESE: End Semester Examination; TW: Term Work

Module	Contents
I	Building information modelling (BIM)
II	Excel: Basic function required for preparing database, statistical analysis of the data and its graphical representation a. Creation of database of result obtained from Traffic volume survey and its analysis b. Creating database of results obtained from laboratory experiments and its analysis c. Preparation of programme using various functions in excel or any other relevant exercise in civil engineering field 1. Mix design of concrete 2. Design of pavement 3. Design of structural members **Self-Learning:** Mix design of concrete
III	Use of open-source software for designing and simulation of water distribution network. **Self-Learning:** Simulation of water distribution network
IV	Programming using open-source software C or C++ or java or python. **Self-Learning: python**

CATEGORY OF TECHNOLOGY	SUB - TOPIC	Hands-on Project/Assignment
Python	History and Introduction of Python. Application of Python Features of Python. Flavours of Python, Data types, Identifier Reserve Keywords, PVM, String Slicing Typecasting, String Function	Practical Programs machine test of each topics. Practice on Hacker rank and infytq company based questions
Python (Logic Building)	Collection Data types: List, Tuple, Set, frozen set, Dictionary, Operators, Conditional statements, simple if, if else, nested if else	Practical programs machine test of each topics. Practice on Hacker rank and infytq company based questions
Python (Logic Building) and Library	Looping Statement: for loop, while loop, nested for loop, Transfer statement, break & continue, Numpy, Pandas	Practical programs machine test of each topics. Practice on Hacker rank and infytq company based questions
Python (functional and) conceptual Implementation	Types of Function, types of arguments, default, keyword, and positional, variable length argument lambda function. Generator fuction, Decorster, Predefine and User define module concept, Package concept.	Practical Programs machine test of each topics. Practice on Hacker rank and infytq company based questions

Bachelor of EngineeringIn Civil Engineering

Final Year
Semester – VII (Rollover Batch)

REVISION: SJCEM RO – 24

Effective from Academic Year 2024-25

Board of Studies
Approval: Academic
Council Approval:

Program Structure for Final Year VII Semester, Civil Engineering

St. John College of Engineering and Management (Autonomous)

(With Effect from 2024-2025)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CEPCC701	PCC	Design & Drawing of Reinforced Concrete Structures	3	1	-	3	1	-	4
24CEPCC702	PCC	Quantity Survey, Estimation and Valuation	3	1	-	3	1	-	4
24CEPCE701X	PCE	Department Level Optional Course 3	3	-	-	3	-	-	3
24CEPCE702X	PCE	Department Level Optional Course 4	3	-	-	3	-	-	3
ILOC70X	OE	Institute Level Optional Course 1	3	-	-	3	-	-	3
24CEVSEC701	AEC	Employability Enhancement Program – 7	-	-	2	-	-	1	1
24CEPRJ701	PRJ	Major Project 1	-	-	4	-	-	2	2
Total			**15**	**2**	**2**	**15**	**2**	**3**	**20**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE-I	IAE-II	ESE	TW	OR/PR	Total
24CEPCC701	PCC	Design & Drawing of Reinforced Concrete Structures	20	20	60	25	-	125
24CEPCC702	PCC	Quantity Survey, Estimation and Valuation	20	20	60	25	-	125
24CEPCE701X	PCE	Department Level Optional Course 3	20	20	60	-	-	100
24CEPCE702X	PCE	Department Level Optional Course 4	20	20	60	-	-	100
ILOC70X	OE	Institute Level Optional Course 1	20	20	60	-	-	100
24CEVSEC701	AEC	Employability Enhancement Program – 7 (EEP – 7)				25	-	25
24CEPRJ701	PRJ	Major Project 1	-	-	-	50	25	75
Total			**100**	**100**	**300**	**125**	**25**	**650**

DESIGN & DRAWING OF REINFORCED CONCRETE STRUCTURES

Semester: VII			**Term:**				**Course Code: 24CEPCC701**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE-1**	**IAE-2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	2	-	3	1	-	4	20	20	60	25	--	125

IAE: Internal Assessment Examination, ESE: End Semester Examination, TW: Term Work

Course Objectives- *The objective of the content titled is to equip learners with the ability to:*

1. To explain the LSM design procedure of G+3 RCC framed building by application of IS code clauses including loading calculations, analysis and design of individual elements with detailing of reinforcements.
2. To explain the LSM design procedure of G+3 RCC framed building by application of IS code clauses including loading calculations, analysis and design of individual elements with detailing of reinforcements.
3. To explain the concepts in the design of water tanks.
4. To explain the concepts in the design of retaining walls.
5. To introduce the basics of structural dynamics, structural behavior under the dynamic load and the effect of damping.
6. To introduce earthquake resistant design approach.

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

1. Analyze and design various reinforced concrete elements such as Staircase
2. Design G+3 RCC framed building using IS code recommendations.
3. Design different types of retaining walls with detailing of reinforcement
4. Design different types of water tanks with detailing of reinforcement.
5. Apply the basic concepts of structural dynamics
6. Evaluate the response of structure during an earthquake and calculate design forces.

Module	**Contents**	**Hrs**	**COs**

I	**Design of Saircase:-** Design of Staircase (Dog legged and Open well type) **Self-Learning;-** Detailed study of Reinforcement details of staircase. **Comprehensive Design of Building**: Analysis and design of residential/commercial/industrial (G+ 3) RCC framed building. Load transfer mechanism, arrangement of beams, slabs and columns. Slabs (One way and Two way with continuity), Beams (Simply supported, Cantilever, Continuous), **Self Learning;-** Columns (Axially loaded and eccentrically loaded), Footings (Isolated and Combined).	12	CO-01
II	**Design of retaining wall:-** Design of Cantilever retaining wall Design of Counterfort retaining wall **Self Learning;-**Detailed study of reinforcement of Retaining Wall	07	CO-03
III	**Design of Water Tank** Classification of Water Tank, Permissible Stresses, and Design of circular and rectangular water tanks resting on ground and underground. Codal provisions as per IS 3370:2020. Use of IS coefficient method and approximate method. **Self Learning:-** Introduction to design ofelevated water tank, frame and shaft type of staging.	08	CO-04
IV	**Introduction to Structural Dynamics :** Definition of basic terms used in structural dynamics. Static and dynamic loads, types of dynamic load. Introduction to single degree of freedom system (SDOF), evaluation of dynamics response of SDOF system. **Self Learning:-** Approximate method for determination of time period of vibration.	07	CO-04
V	**Earthquake Resistant Design of Structures:** Earthquake motion and response of structure. Design load calculation by seismic coefficient method. Ductile design and detailing as per IS: 13920.	07	CO-05
VI	**Introduction to Pre-stressed Concrete** Prestressed Concrete: basic principles of prestressed concrete, materials used, systems of prestressing. Losses in prestress**.**	04	CO-06

Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three

Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Term Work:

1. Term work should consist of 10 Tutorials
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Tutorials	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference
10 marks	05 marks	10 marks

Recommended Books:

1. Design of Reinforced Concrete Structures: Dayaratnam, P; Oxford and IBH.
2. Reinforced Concrete - Limit State Design: Ashok K. Jain, Nemchand & bro.
3. Limit State Design of Reinforced Concrete: Shah and Karve, Structure Publications, Pune.
4. Design of Prestressed Concrete Structures: Lin T.Y. and Ned Burns; John Wiley.
5. Reinforced Concrete: H.J. Shah, Charotar Publishers, Anand.
6. Prestressed concrete : Krishna Raju, Tata Mc-Graw Hill Publishing House, New Delhi
7. Illustrated Reinforced Concrete Design: Dr. V. L. Shah and Dr. S. R. Karve, Structure Publications, Pune.
8. Reinforced Concrete Design: Wang, C. K., Salmon, C. G., and Pincheira, J. A, John Wiley (2007),7th Edition.

Reference Books:

1. Design of RCC structural Elements (RCC Vol-I): Bhavikatti, S. S., New Age International Publications.
2. Reinforced Concrete: Syal and Goel, Wheeler Publishers.
3. Reinforced Concrete Design: Pillai, S.U. and Menon Devdas, Tata Mc-Graw Hill Publishing House, New Delhi.
4. Reinforced Concrete Design by S.N. Sinha, Tata Mc-Graw Hill Publishing House, NewDelhi.
5. Theory of Reinforced concrete structures by N. Subramanian, Oxford University Press.
6. Pre-stressed concrete: N. Rajgopalan, Narosa Publishers.

7. Relevant IS Codes: BIS Publications, New Delhi.

Quantity Survey, Estimation & Valuation

Semester: VII			Term:				Course Code: 24CEPCC702					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract	Total
Th	Tu	Pr	Th	Tu	Pr							
3	2		3	1		4	20	20	60	25	25	150

IAE: Internal Assessment Examination, ESE: End Semester Examination, TW: Term Work

Course Objectives:

1. To emphasize the importance of relevant IS: 1200 - 1964 codes and understand Measurement systems for various items of civil engineering structures
2. To draft the specifications for various items of work & determine unit rates of items of works & to prepare the rate analysis for various items of work using DSR for reference.
3. To study the various methods of detailed and approximate estimates.
4. To calculate the quantity of earthwork using various methods.
5. To study the process of tendering and its various stages, various types of contracts, its suitability and validity as per the Indian Contract Act of 1872 and draft various clauses and conditions of a contract.
6. To explain the concept of valuation & to determine the present fair value of any constructed building at stated time.

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

1. Apply the measurement systems to various civil engineering items of work.
2. Draft the specifications for various items of work & determine unit rates of items of works
3. Estimate approximate cost of the structures by using various methods & prepare detailed estimates of various civil engineering structures, including bar bending schedule, by referring drawings.
4. Assess the quantities of earthwork & construct mass haul diagrams.
5. Draft tender notice & demonstrate the significance of the tender as well as contract process.
6. Determine the present fair value of any constructed building at stated time

Module	Contents	Hours	COs

I	1.1 Importance of Course 1.2 Measurement systems for specific items of civil engineering structures 1.3 Units of measurement of various items of works **Self-learning:** Introduction, deduction rules for Masonry & Plastering work.	04	01
II	Specifications & Rate Analysis 2.1 Types & importance of specifications, rules to be followed for drafting the specifications of important items of work etc. 2.2 Rate analysis, its importance & necessity, Factors affecting rate analysis, Task work, sources of materials, Study of IS 7272 regarding labor output. **Self-learning:** District Schedule of Rates (DSR) Rate analysis of important items of construction works.	07	02
III	3.1 Approximate Estimate : Definition & Purposes of approximate estimates, Methods for preparing approximate estimates & numerical based on methods, Various terms such as administrative approval, technical sanction, Contingencies, Work charged establishments etc. 3.2 Detailed Estimate: Definition & purposes of detailed estimate, Data required for preparation of detailed estimate. Introduction of detailed estimate of load bearing structure. Methods of taking out quantities such as long wall & short wall method, Centre line method for R.C.C. framed structure, Bar Bending Schedule & its necessity. **Self-learning:** preparation of bar bending schedule of various structuralelements as per code IS2502.	13	03
IV	Estimation of Earthwork for Roads & Canals Methods of computation of volume of earthwork such as mean area method, mid-sectional area method, Prismoidal formula, Trapezoidal formula etc. & numerical based on methods. **Self-learning:** Introduction of Mass Haul diagram, Terms like lead & lift etc.	06	04

V	Tenders & Contracts Tenders: Definition & types of tenders, Tender notice & its inclusions, Pre-qualification of contractors, Pre-bid meeting, Procedure for submission & opening of tender, acceptance & rejection of tender, Tender validity period, E-Tendering Contract: Definition, basic forms such as Valid, void & voidable contract. **Self-learning:** General types of contracts with their suitability, conditions of contract	07	05
VI	Valuation: Difference between cost, price & value. Types of value, Valuation & its purposes. Various terms such as depreciation, sinking fund, capitalized value, years purchase etc. Methods for calculating depreciation of building such as Straight-line method, Sinking fund method Freehold Properties, Leasehold Properties, Easement rights 6.2 Methods of valuation such as Rental method, land & building method, **Self-learning:** Belting method and Numerical based on valuation	08	06

Sr. No	List of Tutorial	
1	Market Survey for rates of materials & items	
2	Study of District Schedule of Rates & Prepare rate analysis of few important Items of work.	
3	Prepare approximate estimate of residential building	
4	Prepare detailed estimate (Measurement sheet & Abstract Sheet) of any two of the following • RCC structure • Road work • Cross drainage work	
5	Work out Steel quantity by using BBS	
6	Work out earthwork volume in banking & cutting for a Road section	
7	Draft Tender Notice for proposed construction Project & study tender documents & Conditions of contract	
8	Prepare Valuation Report of any Civil Engineering Structure	

Evaluation Scheme and Assessment: Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Term Work:

1. Term work should consist of 10 experiments or 10 Tutorials (Whichever is applicable)
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks:

Experiments	**Attendance (Theory & Practical)**	**Assignments/Mind map/Case study/ GD/Solution for societal problem/ Field visit/As per subject need and teacher preference**
10 marks	05 marks	10 marks

Reference Books:

1. Estimating, Costing, Specifications and Valuation: Chakraborty, M., Kolkata.
2. Building and Engineering Contracts: Patil, B. S., University Press, Hyderabad.
3. Estimating and costing: Datta, B. N., UBS Publications
4. Relevant Indian Standard Specifications, BIS Publications
5. Professional Practice: Dr. Roshan H. Namavati

Text Books:

1. World Bank approved contract documents

Advanced Construction Technology

Semester: VII			**Term:** ODD				**Course Code: 24CEPCE7011**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination, ESE: End Semester Examination, TW: Term Work

Course Objectives:

1. To study and understand the latest construction techniques applied to engineering construction for sub structure.
2. To summarize the students about various techniques of super structure construction.
3. To give an experience in the implementation of new technology concepts which are applied in field of advanced construction in special structures.
4. To know the different methods of some advanced construction techniques and ground improvement techniques.
5. To present the new technology related to dredging system and its concepts related advanced construction technology.
6. To study different methods of rehabilitation and strengthening in construction to successfully achieve the structural design.

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

1. Evaluate the procedure of construction techniques for sub structure of major civil engineering projects.
2. Get a thorough knowledge of various stages of construction of super structure of major civil engineering projects.
3. Gain an experience in the implementation of new construction technology on engineering concepts which are applied in field Advanced construction technology in special structures.
4. Get a diverse knowledge of the different methods of advancement in construction techniques and ground improvement techniques.
5. Learn various dredging systems for major civil engineering projects.
6. Explain the theoretical and practical aspects of rehabilitation and strengthening techniques in civil engineering along with the design and management applications.

Module		Course Module / Contents	Hrs
I		**Sub Structure Construction**	07
	1.1	Box jacking, Pipe jacking, Underwater drilling, blasting, and concreting. Underwater construction of diaphragm walls and basement	
	1.2	Driving well and caisson, sinking cofferdam, cable anchoring, and grouting. Driving diaphragm walls, sheet piles	
	1.3	Laying operations for built-up offshore system, Shoring for deep cutting, large reservoir construction, and well points. **Self-Learning:** Dewatering forunderground open excavation.	
II		**Super Structure Construction for building**	07
	2.1	Vacuum dewatering of concrete flooring, Concrete paving technology	
	2.2	Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections, Erection techniques of tall structures, large span structures, launching techniques for heavy decks, in- situ prestressing in high rise structures, post-tensioning of the slab, aerial transporting, Handling. **Self-Learning:** Erecting lightweight components on tall structures.	
III		**Construction of Special Structures**	07
	3.1	Erection of lattice towers - Rigging of transmission line structures, Construction sequence in cooling towers, Silos, chimneys, skyscrapers. Construction sequence and methods in domes, Support structure for heavy equipment and machinery in heavy industries, Erection of articulated structures and space decks.	
	3.2	Roof truss: erection problems Building / Industrial component, Equipment and tackles used for erecting these. Plate girder Launching a portion of bridge girder, large span lattice girder. Erection of chimney**,** **Self-Learning:** Erection of overhead tank.	
		Advancement in Construction techniques	
	4.1	Building construction techniques: Zero energy building, green building, pre- engineering building, Solar Paints, Building Integrated Photovoltaic (BIPV), Earthquake Resisting Controls-Isolation and Dissipation.	
	4.2	Coastal construction techniques: Sound Proofing walls, water-resistant roofs, high-performance doors and windows, air and moisture barriers.	

IV	4.3	Road construction techniques: 3D Printing, Road Printer, smart roads	09
	4.4	Ground improvement techniques: Advanced piling techniques - Stone Column, Vibro Floatation, Grouting, Geotextile application, Micro Piles, and Soil Nailing. Vertical drains-Sand Drains, Pre-Fabricated Vertical Drains. **Self-Learning:** Thermal Methods- soil heating and soil freezing.	
V		**Dredging**	07
	5.1	Dredging System, Mechanism, Hydraulic dredger in waves, dredging equipment, Water & Booster System, dredging in the navigation system, Agitation dredging system, silt dredging system, water injection system, Pneumatic dredging system, Amphibious & scrapper dredging system.	
	5.2	Advantages & Disadvantages of Various Dredging Systems, Production **Self-Learning:** Cycle for Dredgers, Application, Capacity of dredgers, & its economicaluse, dredging economics	
VI	**Rehabilitation and Strengthening Techniques**		08
	6.1	Seismic retrofitting, strengthening of beams, strengthening of columns, strengthening of the slab, strengthening of a masonry wall, Protection methods of structures, Mud jacking and grouting for foundation, Micro piling and underpinning for strengthening floor and shallow profile, Subgrade waterproofing, Soil Stabilization techniques	
	6.2	Repair of steel structures, bridge, building, towers etc., monuments and historical structures. Prevention of water leakage in structures; Underwater repair; Durability of repairing material. **Self-Learning:** Maintenance of underground railways.	

Evaluation Scheme and Assessment: Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the firstthree Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Recommended Books:

1. Roy Chudley and Roger Greeno , Construction Technology , Prentice Hall, 2005.
2. Dr. B.C. Punamia (2008); "Building Construction" Laxmi Publications (P) Ltd.ISBN13: 978-8131804285. 666p.
3. S. S. Bhavekatti (2012); "Building Construction" Vikas Publishing House Pvt Ltd. ISBN-13: 978-9325960794. 356p.
4. Peter. H. Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.
5. S. P. Arora and S. P. Bindra (2010); "Textbook of Building Construction", Dhanpat Rai & Sons publication, ISBN-13: 978-8189928803. 688p
6. Sushil Kumar (2010); "Building Construction" Standard Publishes-Distributors. ISBN-13: 978-8180141683. 796p.
7. S.C. Rangwala, Building Construction, Charotar Publication Pvt Ltd. Anand

Reference Books:

1. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.
2. Peurifoy, Construction Planning, Equipment and methods –-Tata McGraw Hill Publication
3. Mahesh Varma , Construction Equipment Planning and Applications –
4. R. Chudley (revised by R. Greeno), Building Construction Handbook, Addison Wesley, Longman Group, England, 3rd ed.
5. S.S. Ataev, Construction Technology, Mir Publishers, Moscow
6. Robertwade Brown, "Practical foundation engineering hand book", McGraw Hill Publications.
7. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons
8. Jerry Irvine, Advanced Construction Techniques, CA Rocketr

Pavement Materials, Construction and Maintenance

Semester: VII			**Term:** ODD				**Course Code: 24CEPCE7012**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

Course Objectives:

1 To give the students hands on experience on various material properties and testing procedures of pavement materials as per IRC standards. To study the soil classification for highway engineering purpose as per different classification system.

2 To understand the concept of stresses in soil. To enable the student to identify the basic deficiencies of various soil deposits and to arrive upon the various ways and means of improving the soil and implementing the techniques of improvement.

3 To understand the requirements of aggregates as per IRC code.

4 To learn bituminous types and mix designs.

5 To understand the different types of distresses in pavement, evaluation of the existing pavements using different methods and rehabilitation of the distressed pavements. To study the construction of the concrete roads and low volume roads

6 To learn basic principles of super pave technology of bituminous mixes

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

1. Explain the soil classification in accordance with various soil classify the system and evaluate the ability of the soil as a subgrade material in terms of standard engineering parameters.
2. Describe the stress distribution in subgrade soil and the various ground improvement methods.
3. Evaluate the requirements and desirable properties of the aggregate to be used in the construction of pavements.
4. Compare the characterization of different surface paving (Bitumen) materials as per IRC code.
5. Explain the various causes leading to failure of pavement and remedies for the same and the construction of the concrete roads and low volume roads
6. Apply basic principles of mix design of cement concrete and bituminous mixes.

Module	Course Module / Contents		Hrs
I	Soil		06
	1.1	Soil-Classification methods	
	1.2	Tests on Soil: CBR test, effect of lateral confinement on CBR and E value of Subgrade soil, Consistency, Engineering Properties and Modulus of sub-grade reaction of soil, estimation of modulus of subgrade reaction, Static and cyclic plate load test, correction for plate size, correction for worst moisture content.	
	1.3	**Self-Learning:** Soil classification as per HRB.	
II	Stresses in Soil		09
	2.1	Theories of elastic and plastic behavior of soils, Cyclic triaxial test on subgrade soils, resilient deformation, resilient strain, resilient modulus.	
	2.2	Stabilized Soils: Method of sampling and Preparation of Stabilized Soils for testing, Relation for Moisture content and Dry Density of Stabilized mixes, UCS of Stabilized soil, test for: soil bituminous, soil lime and soil. **Self-Learning:** fly ash mixes. (IRC: SP:89 (Part II)-2018)	
III	**Aggregates**		05
	3.1	Classification, requirements, Blending of aggregates, Importance of aggregate shape factor in mix design	
	3.2	**Self-Learning:** Grading requirements for aggregate, selection of bases and sub-base material (including stabilized materials),	
IV	**Bitumen, Tar and Bituminous Mix Design**		10
	4.1	Binders: Requirements, criteria for selection of different binders, Temperature susceptibility, Bituminous emulsion and Cutbacks, fillers, extenders Polymers, Crum rubber, and rubber modified bitumen and anti-Stripping agents on pavement performance.	

	4.2	Bituminous Mix Design: selection of different grade of bitumen, skid qualities, types of bituminous surfaces, bituminous mix design, Marshall Stability test, design aspect of paving concrete. **Self-Learning:** Experimental characteristics of road aggregate.	
V	**Evaluation and strengthening**		10
	5.1	Flexible and rigid pavement distresses, condition and evaluation surveys, present serviceability index, roughness measurement, Benkelman beam deflections, skid resistance and measurement	
	5.2	Highway construction: Construction of WBM roads, Bituminous pavements, cement concrete roads, Reinforced concrete pavements construction.	
	5.3	Quality control (QC) and Quality assurance (QA) during construction of various pavements.	
	5.4	**Self-Learning:** Low-Cost Roads (Rural Areas) (IRC-SP-20-2002) Classification of low- cost roads, construction of low-cost roads.	
VI	Introduction to Super pave Technology		05
	6.1	Methods of selection of suitable ingredient for super pave method, Gyratory compaction, rolling thin film oven, pressure aging vessel, rotational viscometer, dynamic shear rheometer, bending beam rheometer, direct tension test.	
	6.2	Use of super pave perform and grade binder specifications. **Self-Learning:** Comparison between Marshal Mix method and Super pave method.	

Evaluation Scheme and Assessment: Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Recommended Books:

1. Highway Engineering: *Khanna, S.K., Justo, C,E.G. and Veeraragavan, A.*,Nem Chand and Brothers, Roorkee (10th Revised Edition, 2014)

2. Principles and Practices of Highway Engineering; *Dr. L. R. Kadiyali and Dr. N. B.Lal*, Khanna
3. Publishers, New Delhi.
4. Highway Engineering, *Sharma, S.K.*, S. Chand Technical Publishers, New Delhi (3rd
5. Revised Edition, 2013).
6. Principles of Transportation and Highway Engineering: *Rao, G.V.*, Tata Mc-Graw Hill Publications, New Delhi

Reference Books:

1. Principles of Pavement Design, Second Edition, 1975: *Yoder, E.J.*, John Wiley and Sons, Inc., New York.
2. Concrete Roads: *HMSO*, Road Research Laboratory, London

Pre-stressed Concrete

Semester: VII			**Term:** ODD				**Course Code: 24CEPCE7013**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

Course Objectives:

1. To make the learner to understand difference between PSC and RCC section in terms of material and method / technique used for construction.
2. To make the learner to understand the principle of prestressing, analysis of prestressed concrete sections and losses in prestress.
3. To make the candidate able to understand and implement the guidelines of Indian Standard code for analysis and design sections using limit state philosophy.

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

1. Explain the concept of pre-stressing, its casting techniques and applications.
2. Describe difference between RCC and PSC elements and their behavior.
3. Estimate the loss of stresses in pre-stressing steel.
4. Analyze and design the pre-stressed concrete element using relevant IS Code.

Module	**Course Module / Contents**		**Hrs**
I	**Introduction of Pre-stressed Concrete**		03
	1.1	Basic concept and general principle	
	1.2	Materials used and their properties, need of high strength concrete and steel	
	1.3	Techniques and systems of prestressing	
	1.4	**Self-Learning:** Advantages of Prestressed Concrete	
II	**Analysis of Pre-stressed Concrete Beams**		10
	2.1	Loading stages, permissible stresses in concrete in compression and tension at transfer and service stages as per limit state of serviceability, maximum compression and limit state of serviceability cracking, permissible stresses in steel, stress method of analysis	
	2.2	Load balancing method of analysis, cable profile	

	2.3	**Self-Learning:** Kern points, pressure line, efficiency of section, internal resistingcouple method of analysis,	
III	**Losses in Prestress**		06
	3.1	Loss of stresses in steel due to elastic deformation of concrete, creep in concrete, shrinkage in concrete, relaxation in steel, **Self-Learning:** Anchorage slip and friction	
IV	**Analysis of Pre-stressed Concrete Beams in Limit State of Serviceability Deflection**		04
	4.1	**Self-Learning:** Deflection at transfer, short time and longtime deflection ofuncracked beams, permissible limits	
V	**Analysis and Design of Pre-stressed Concrete Beams in Limit State of Collapse**		10
	5.1	Shear - Principal tension, permissible limit, analysis and design of beams in shear (sections uncracked in flexure)	
	5.2	**Self-Learning:** Flexure - General philosophy of design, assumptions, analysis anddesign of beams in flexure	
VI	**Design of Pre-stressed Concrete Beams in Limit State of Serviceability, Maximum Compression and Cracking**		08
	6.1	Suitability of section modulus	
	6.2	Optimum pre-stressing force and corresponding eccentricity	
	6.3	**Self-Learning:** Safe cable zone	

Evaluation Scheme and Assessment: Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Site Visit:

The learners shall visit a construction site of pre-stressed concrete and submit a report.

Recommended Books/Code:

1 Prestressed Concrete*: N. Krishna Raju*, Tata McGraw-Hill Publishing Company Limited, New Delhi

2 Fundamentals of Prestressed Concrete: *N.C Sinha* and *S.K. Roy*, S. Chand Publishing

3 Prestressed Concrete: *N. Rajagopalan*, Narosa Publishing House

4 Prestressed Concrete Structures: *P. Dayaratnam*, Oxford and IBH Publishing Co. Pvt. Ltd.

5 Prestressed Concrete*: S. Ramamrutham*, Dhanpat Rai Publishing Company Pvt. Ltd, New Delhi

6 IS code: IS:1343-2012

Reference Books:

1 Design of Prestressed Concrete Structures: T. Y. Lin and N.H. Burns, Wiley India Pvt. Ltd.

2 Design of Prestressed Concrete: *Arthur H. Nilson*, Wiley

Solid and Hazardous Waste Management

Semester: VII			**Term:** ODD				**Course Code: 24CEPCE7021**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

Course Objectives:

1. To describe functional elements of solid waste management and its need.
2. To explain the segregation and transportation of municipal solid waste.
3. To recognize waste disposal methods and energy recovery techniques.
4. To comprehend the necessary knowledge and concepts of landfill for disposal.
5. To demonstrate hazardous waste management through its safe handling and disposal.
6. To identify assorted types of solid waste.

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

1. Acquire the knowledge of functional elements of solid waste management
2. Illustrate solid waste collection system, route optimization techniques, transfer station and processing of solid waste.
3. Develop the ability to plan waste minimization and processing of solid waste.
4. Explain approaches to treat the solid waste in the most effective manner for sustainable development.
5. Discuss safe methods of handling, management and disposal of hazardous waste.
6. Summarize waste management techniques used for assorted solid waste

Module	**Course Module / Contents**	Hrs
	Municipal Solid Waste Management	

I	1.1	**Introduction:** Sources, Types, Quantities, Composition, sampling of wastes, Properties of wastes, Numericals related to moisture content, density and Energy content, Problems and issues of solid waste management - Need for solid waste management- Awareness programme, Legal issues related to solid waste disposal	08
	1.2	**Functional Elements of SWM**- waste generation (factors affecting), storage, collection, transfer and transport, processing, recovery and disposal in the management of solid waste. **Self-Learning:** 7R concept	
II		**Waste Segregation, Storage, Collection and Transport**	08
	2.1	**Segregation** - wet and dry method, Volume reduction at source, Recycling and Reuse of waste, **Methods of collection** - House to House collection, On site storage of municipal solid waste, Hauled container and stationary container system, **Collection Routes;** Optimization of transportation routes, Numericals on container and collection systems.	
	2.2	**Self-Learning:** Transfer station -Significance, Site selection, Types, Material Recovery facility	
III		**Waste processing techniques and Energy Recovery**	08
	3.1	**Waste transformation- Biological and Thermal** Biological Conversion Technologies – Composting, Factors affecting for composting, Various Composting Methods as Indore and Bangalore, Vermi, Mechanical and In vessel composting, Numericals on aerobic and anaerobic Composting	
	3.2	**Self-Learning:** Thermal conversion technologies – Incineration, Pyrolysis, Gasification, Refuse derived fuel	
IV		**Landfills for Disposal of Waste**	07
	4.1	Landfill Classification-Sanitary, Secure and Bioreactor, Design criteria for landfill site selection, operation and maintenance, Landfill methods -Trench, Area, Slope	
	4.2	Leachate generation, Characteristics and it's control methods. Landfill gas management and landfill closure	
	4.3	**Self-Learning:** IoT in solid waste management	

V		**Hazardous Waste Management**	06
	5.1	**Introduction:** Sources, Characteristics and classification of hazardous wastes, Storage, Handling, Collection, Transportation and Minimization, Need for Hazardous Waste Management	
	5.2	**Treatment and Disposal and Hazardous Site remediation** – onsite and offsite Techniques. Hazardous waste management using secure landfill, Disposal practices in Indian Industries. **Self-Learning:** Hazardous Waste Management Rules 2016.	
VI		**Assorted Solid Wastes**	08
	6.1	**Biomedical waste:** Need for Biomedical Waste Management, Sources, Classification, Storage and Segregation- Color coding, Collection and Transportation, Treatment and Disposal. Latest Biomedical waste management rules.	
		Electronic Waste: Types, Component separation, Collection, Recycling and Recovery, E- waste management techniques. **Self-Learning:** Latest E- waste management rules	
	6.2	**Plastic Waste:** Problems related to plastic wastes, Plastic waste management- Recycling & recovery, Energy production, Plastic waste management- Rules and Regulation **Self-Learning:** Construction and Demolition waste: Composition, Recycling and reduction, Proper Management	

Evaluation Scheme and Assessment: Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Site Visit:

The learners shall visit a construction site of pre-stressed concrete and submit a report.

Recommended Books:

1. Integrated Solid Waste Management: Techobanglous, Thisen and Vigil, McGraw Hill International.
2. Hazardous Waste Management: Lagrega, Buckingham and Evans, McGraw Hill International.
3. Solid Waste Management in Developing Countries: A.D. Bhide, Nagpur publications.
4. Environmental Pollution Control Engineering: C.S. Rao, Wiley Eastern, Manual of solid waste of management, CPHEEO.
5. E-Waste: Implications, Regulations, and Management in India and Current Global Best Practices, Rakesh Johri, The Energy and Resources Institute.
6. Biomedical Waste Management in India: Jugal Kishore and G. K. Ingle, Century Publications
7. Advances in Construction and Demolition Waste Recycling Management, Processing and Environmental Assessment, Fernando Pacheco-Torgal, Yining Ding, Francesco Colangelo, Rabin Tuladhar, Alexander Koutamanis.
8. Plastics Waste Management, Disposal Recycling and reuse, Marcel Dekker, Inc. New York, 1993- Nabil Mustafa.
9. CPHEEO, "Manual on Municipal Solid Waste Management" Central Public Health and Environmental Engineering Organization, Government of India, New Delhi , 2000.
10. MSW Rules 2016," Swachh Bharat Mission and Smart Cities Program of India.
11. Hazardous and other Wastes Management Rules,2016

Ground Improvement Techniques

Semester: VII			**Term:** ODD				**Course Code: 24CEPCE7023**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

Course Objectives:

1. To enable students to identify problematic soils, associated issues and need for ground improvement.
2. To make the students understand shallow and deep compaction techniques, importance of pre- compression and vertical drains.
3. To make the students understand different soil stabilization techniques.
4. To make the students learn the concepts, purpose and effects of grouting.
5. To make the students understand application of stone column technique.
6. To provide students the concept of reinforced earth, soil nailing and ground anchors.

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

1. Identify the problems associated with the existing ground conditions and recognize the need forground improvement.
2. Explain shallow and deep compaction techniques, pre-compression and vertical drains as wellas estimate maximum dry density and consolidation settlement.
3. Evaluate soil stabilization and select the effective soil stabilization technique.
4. Apply knowledge of grouting as per IS 14343:1996.
5. Design stone column as per IS 15284-1 (2003).
6. Describe reinforced earth mechanism, multiple functions of Geosynthetics and evaluate capacity ofanchors

Module	Course Module/ Contents	Hrs
I	Introduction: Different types of problematic soils and concerns (inadequate mechanical properties, swelling and shrinkage - expansive soils, collapsible soils, marshy and soft soils, organic/ peaty soils, loose sandy or gravelly deposits, liquefiable soils, karst deposits, foundation on dumps and sanitary landfills, old mine pits, etc.); Need for ground improvement; Control of ground improvement works; Ground improvement techniques for different soil types (principles, applicability to various soil conditions, material requirements, equipment's required, results likely to be achieved and limitations); Grain size ranges for different treatment methods; Classification of ground modification techniques; Factors affecting the selection of ground improvement techniques; Benefits/objectives of ground improvement techniques, Emerging trends in ground improvement techniques (Types and brief discussion on constructive use of waste materials, low-cost technologies with soil and additives, Geosynthetics, biotechnical stabilization, etc.) **Self-Learning:** IS 13094 (1992): "Selection of ground improvement techniques for foundation in weak soils – Guidelines"	08
II	**Compaction and Consolidation** Shallow compaction: laboratory and field methods of compaction, compaction curve, advantages of compaction, effect of compaction; Deep compaction: objectives, brief discussion on dynamic compaction (types of dynamic compaction, evaluation of improvement), dynamic consolidation, dynamic replacement, Vibro-compaction or, Vibro-floatation, Vibro replacement, blasting; Precompression and vertical drains: Precompression or preloading (principle, settlement without and with Precompression), accelerated consolidation by sand drains, free strain and equal strain cases, design of sand drain layout. **Self-Learning:** Brief discussion on prefabricated vertical drains (PVDs), advantages of PVDs over sand drains.	**08**
III	**Stabilization of Soil** Methods of stabilization; mechanical stabilization; lime, cement, fly-ash, bitumen, chemicals and polymer stabilization. **Self-Learning:** Electrokinetic stabilization.	**06**
IV	**Grouting**	**07**

	Grouting technology, grout materials, choice of a grout material, classification, general relationship between permeability and groutability; Particulate grouts: characteristics of grout materials, characteristics of grout slurries; Non- particulate grouts: types of chemical grouts, salient features of chemical grouts, grout properties (mechanical properties, chemical properties, economic factors), penetrability and performance aspect of coarse and fine grouts, limits of groutability based on grain size distribution; Various applications of grouting. **Self-Learning:** IS 14343:1996 "Choice of Grouting Materials for Alluvial Grouting – Guidelines"	
V	**Stone Columns** Some important features of stone column treatment: influence of soil type, influence of construction methodology, treatment depth, area of treatment; Basic design parameters: stone column diameter, pattern, spacing, equivalent diameter, replacement ratio, stress concentration factor; Failure mechanisms; Design considerations; Estimation of load capacity of a stone column (unit cell concept); Settlement analysis by the reduced stress method; Granular blanket; Field loading tests; Installation techniques of stone columns: non-displacement method, displacement method, vibro-replacement method; Vibrofloat and rammed stone columns; Methods of improving the effectiveness of stone column **Self-Learning:** IS 15284-1 (2003): "Design and construction for ground improvement - Guidelines, Part 1: Stone columns"	08
VI	**Reinforced Earth and Anchors** Theory of reinforced earth concept; Design principles of reinforced earth through Mohr circle analysis; Necessity of reinforced earth; Materials; Introduction to Geosynthetics: scope and definitions, multiple functions of Geosynthetics (Separation, Filtration, Drainage, Reinforcement, Protection (Cushion), Barrier/Containment/Waterproofing, Erosion Control), areas of applications; **Self-Learning:** Introduction to soil nailing and ground anchors; Capacity of shallow horizontal strip anchor by using Mononobe-Okabe method.	08

Evaluation Scheme and Assessment:
Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.

End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Site Visit:

The learners shall visit a construction site of pre-stressed concrete and submit a report.

Recommended Books:

1. P. P. Raj (2016). "Ground Improvement Techniques", Second edition, Laxmi Publications (P) LTD.
2. M. R. Hausmann (1990). "Engineering Principles of Ground Modification", McGraw-Hill Inc.,US.
3. IS15284 (Part 1): Design and Construction for Ground Improvement–Guidelines: (Stone Column), Bureau of Indian Standards, New Delhi, (2003).
4. Nihar Ranjan Patra (2012). "Ground Improvement Techniques", Vikas Publishing.
5. S. L. Kramer (2013). "Geotechnical Earthquake Engineering", Pearson.
6. B. M. Das (1990). "Earth Anchors", Elsevier

Reference Books and IS Codes:

1. IS 13094 (1992): "Selection of ground improvement techniques for foundation in weak soils – Guidelines"
2. IS 14343:1996 "Choice of Grouting Materials for Alluvial Grouting – Guidelines"
3. IS 15284-1 (2003): "Design and construction for ground improvement - Guidelines, Part 1: Stone columns"
4. R.M. Koerner (1984). "Constructional and Geotechnical Methods in Foundation Engineering (McGraw-Hill series in construction engineering and project management), McGraw-Hill Inc.,US.
5. FHWA Report No. Rd 83/026, (1983) Design and Construction of Stone Columns, Vol I.
6. B. M. Das (2011). "Principles of Foundation Engineering", 7th edition, Cengage Learning.
7. R.M.Koerner (1999). "Designing with Geosynthetics", 4th Edition, Prentice Hall, Jersey.

Green Building Constructions

Semester: VII			Term: ODD			Course Code: 24CEPCE7022						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

Course Objectives:

1. To outline the environmental impact of buildings
2. To explain the concepts of sustainable development and green building
3. To summarize the features of green buildings
4. To explain green building rating systems
5. To describe green audit
6. To explain green retrofitting

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

1. Explain environmental impact of buildings, discuss the concepts of sustainable development & green buildings and overview the features of green buildings
2. Describe site selection, planning and designing of green buildings
3. Explain water conservation and energy efficiency in green buildings
4. Identify green building materials and indoor environmental quality
5. Apply green building rating systems
6. Describe green audit and green retrofitting

Module	Course Modules / Contents		Hrs
I	**Introduction**		4
	1.1.	Environmental impact of buildings, concept of sustainable development, concept of green buildings, necessity of green buildings, benefits of green buildings	
	1.2.	Overview of features of green building – design and construction efficiency, water efficiency, energy efficiency, materials efficiency, indoor environmental quality, waste reduction,	

		operations and maintenance	
	1.3.	**Self-Learning:** Examples of green buildings	
	Site Selection, Planning and Design		
	2.1.	Site preservation	
	2.2.	Passive architecture	
	2.3.	**Self-Learning:** Soil erosion control	
II	2.4.	Natural topography and on-site vegetation	**9**
	2.5.	Preservation of transportation of trees on-site	
	2.6.	Heat island reduction	
	2.7.	Optimization in structural design	
	2.8.	**Self-Learning:** Innovation in design process	
	Water Conservation and Energy Efficiency		
	3.1.	Rainwater harvesting	
	3.2.	Water efficient plumbing fixtures	
	3.3.	Irrigation systems	
	3.4.	Wastewater treatment and reuse	
III	3.5.	Water metering	**11**
	3.6.	Wastewater reuse during construction	
	3.7.	Minimum and enhanced energy efficiency	
	3.8.	Commissioning plan for building equipment and systems and post-installation	
	3.9.	On-site and off-site renewable energy	
	3.10	**Self-Learning:** Energy Metering and Management	
	Green building materials and indoor environmental quality		
	4.1.	Sustainable building materials	
	4.2.	Use of certified green building materials, products & equipment	
	4.3.	Segregation of waste, organic waste management and handling of waste materials	
IV	4.4.	Fresh air ventilation	**11**
	4.5.	CO_2 monitoring	
	4.6.	Day lighting	

	4.7.	Minimizing of indoor and outdoor pollutants	
	4.8.	Low-emitting materials	
	4.9.	Occupant well-being facilities	
	4.10	Indoor air quality testing, after construction and before occupancy	
	4.11	**Self-Learning:** Indoor air quality management	
V	**Green building rating systems**		05
	5.1.	Introduction to green building rating systems	
	5.2.	Overview of various green building rating systems	
	5.3.	**Self-Learning:** Indian Green Building Council (IGBC) rating system – overview, benefitsof new green buildings, overview of certification process and project checklist	
VI	**Green audit and green retrofitting**		05
	6.1.	Green audit: pre-audit, on-site audit and post-audit report	
	6.2.	Case study of any one green building audit	
	6.3.	Green retrofit – overview, components of green retrofit: integrated design, occupant behaviour, lighting retrofits, **Self-Learning:** HVAC retrofits,window retrofits, green roof retrofits	

Evaluation Scheme and Assessment: Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The first-class test will cover the first three Course Outcomes, while the second-class test will cover the remaining Course Outcomes. Each test will have a duration of one hour.End Semester Theory Examination:

End Semester exam: 60 Marks will be conducted based on entire syllabus.

Site Visit:

The learners shall visit a construction site of pre-stressed concrete and submit a report.

Recommended Books:

1. Green Building: Principles and Practices by Dr. Adv. Harshul Savla (Notion Press)
2. The Idea of Green Building by A. K. Jain (Khanna Publishers)
3. Green Building Guidance: The Ultimate Guide for IGBC Accredited Professional Examination by Karthik Karuppu (Notion Press)
4. Green Building Materials & Implementation by Dr. V. Murugesh (Notion Press)

5. Green Building Fundamentals by G. Harihara Iyer (Notion Press)

Reference Books/Links:

1. Indian Green Building Council (IGBC) web-site: https://igbc.in/igbc/

2. Leadership in Energy & Environmental Design (LEED) web-site: https://www.usgbc.org/leed

3. Green Building: Principles & Practices in Residential Construction by Abe Kruger and Carl Seville (Delmar Cengage Learning)

4. Green Building through Integrated Design by Jerry Yudelson (McGraw Hill)

5. Green Building Handbook: Volume 1: A Gude to Building Products and their Impact on the Environment by Tom Wooley, Sam Kimmins, Rob Harrison and Paul Harrison (Routledge Publishers)