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

Autonomy Syllabus Scheme of BE / B.Tech in Civil Engineering (Semester: III, V, VII)

Academic Year 2025-26

DEPARTMENT OF CIVIL ENGINEERING
AUTONOMY SCHEME

SJCEM : R-24C

[Applicable for AY 2025-26]

Sr. No.	Heading	Particulars
1	Title of the Course	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
6	Total Credits	Maximum 173
7	Honor / Minor Courses offered	Professional practices in structural Engineering (Additional Credits -18)
8	Eligibility Criteria for Honor /Minor	• Students with no backlog in semesterI, II and III. • The CGPI based on Semester I, II andIII of the students must be 6.75 and above. • For Direct Second Year (DSE) Students – No backlog in semester III and CGPI must be 6.75 and above.

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 activitiesrelated 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 timealong with 13 to 15 hrs of activities preparation, report writing, independent reading etc.

Dr. B. J. Godboley
BoS Chairman

Dr. Kamal Shah
Principal

Bachelor of Engineering

In

Civil Engineering

Second Year

Semester – III

SJCEM R-24C

Effective from Academic Year 2026-27

Program Structure for Second Year III Semester, Civil Engineering

(With Effect from 2026-2027)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CEPCC301B	PCC	Mathematics for Civil Engineering	3	1	-	3	1	-	4
24CEPCC302B	PCC	Geology and Basics of Geotechnology	3	-	2	3	-	1	4
24CEPCC303B	PCC	Fluid Mechanics	3	-	2	3	-	1	4
24CEPCC304B	PCC	Strength of Materials	3	-	2	3	-	1	4
24CEPCC305B	PCC	Building Planning and Computer-Aided Civil Engineering Drawing	-	-	4	-	-	2	2
24CEVEC301B	VEC	Universal Human Values	2	1	-	2	1	-	3
24CEAEC301B	AEC	Employability Enhancement Program -I (Communication)	-	1	-	-	1	-	1
		Total	**14**	**3**	**10**	**14**	**3**	**5**	**22**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
24CEPCC301B	PCC	Mathematics for Civil Engineering	20	20	60	25	-	125
24CEPCC302B	PCC	Geology and Basics of Geotechnology	20	20	60	25	25	150
24CEPCC303B	PCC	Fluid Mechanics	20	20	60	25	25	150
24CEPCC304B	PCC	Strength of Materials	20	20	60	25	25	150
24CEPCC305B	PCC	Building Planning and Computer-Aided Civil Engineering Drawing	--	--	--	50	50	100
24CEVEC301B	VEC	Universal Human Values	10	10	30	25	-	75
24CEAEC301B	AEC	Employability Enhancement Program -I (Communication)	-	-	-	25	-	25
		Total	**90**	**90**	**270**	**200**	**125**	**775**

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.

Mathematics for Civil Engineering												
Semester: III			**Term: Odd**				**Course Code: 24CEPCC301B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Tutorial**	**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, CA: Continuous Assessment

Course Objectives: The course is aimed

1. To develop a solid understanding of the basic concepts related to infinite series, includingconvergence, divergence, and the behavior of sequences.
2. Demonstrate the Fourier series to study the behavior of periodic functions and their applications insystem communications, digital signal processing and field theory.
3. To familiarize with the Laplace Transform, Inverse Laplace Transform of various functions, itsapplications.
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 notapproach a finite limit) using various convergence tests
2. Expand the periodic function by using Fourier series for real life problems and complex engineeringproblems.
3. Apply the concept of Laplace transform & inverse Laplace transform of various functions inengineering problems.
4. Solve Partial differential equations by applying numerical solution and analytical methods for onedimensional 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 2□, Fourier series of even and odd function, Half rangeFourier 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 Laplaceequation, 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 differencebetween 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 squarematrix 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 Continuous Assessment ensures the satisfactory performance of laboratory workand minimum passing marks in Continuous Assessment.
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

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

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.

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: Odd				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, CA: Continuous Assessment

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 thesecharacteristics influence soil properties.
2. To equip students with the skills to interpret and prepare geologic maps and sections and to analyze thechemical and physical properties of minerals in rocks and soils
3. Understand the fundamental principles of soil and rock classification, including the identification andcharacterization of different rock types.
4. Conducting subsurface investigations using both intrusive and non-intrusive methods, and to understandthe 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 analysesof 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 engineeringproperties 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, Surficial deposits **Self-Learning:** 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 soilminerals, **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 intrusiveand 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. Different methods to determine water content, specific gravity and unit weight of soil. **Self-Learning:** Methods of water content other than oven drying methos	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, consistency index, flow index, toughness index, activity. Importance of consistency limits. **Self-Learning:** Sensitivity and thixotropic of soil.	08	CO-06

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 sitein 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 Continuous Assessment ensures the satisfactory performance of laboratory workand minimum passing marks in Continuous Assessment.
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 beconducted.

Text 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: Odd				Course Code: 24CEPCC303B					
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, CA: Continuous Assessment

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 thespecific 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
	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.		

II	Pressure on horizontal, vertical, inclined and curved surface. Buoyancy, centre at Buoyancy, Meta centre and Meta centreheight. 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 inpipes, 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 Continuous Assessment ensures the satisfactory performance of laboratory workand minimum passing marks in Continuous Assessment.
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 beconducted.

Text 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 978938116 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 McGrawHill, 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 HigherEducation.

Strength of Materials												
Semester: III			**Term:** ODD				**Course Code: 24CEPCC304B**					
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; CA: Continuous Assessment

Course Objectives:

1. To learn stress-strain behavior and physical properties of materials and to compute the Stresses developed anddeformation 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 beamsfor 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 elasticmembers.
2. Draw the variation of shear force and bending moment diagram for statically determinate beams fordifferent loading conditions.
3. Analyze the distribution of shear stress and the flexural stress across the cross section of structuralmembers.
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 energystored 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	8	2

	Loads, couple and their combination. **Self-Learning:** Prepare a chart showing SFD & BMD for simply supported and cantilever beam for various loading conditions.		
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 analytical or 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 Continuous Assessment ensures the satisfactory performance of laboratory workand minimum passing marks in Continuous Assessment.
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 beconducted.

Text Books:

1. Strength of Materials: Basavarajaiah and Mahadevappa, Publishers, University press, Hyderabad India3rd 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, NewDelhi
7. Strength of Materials: S.S. Rattan, Tata Mc-Graw Hill, New Delhi.
8. Strength of Materials: M D Dayal, 6th Eddition.

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.

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=35465 CE0A9261E7A52D435465CE0A9261E7A52D4&&FORM=VRDGAR.

Building Planning and Computer Aided Civil Engineering Drawings

Semester: III			Term: ODD				Course Code: 24CEPCC305B					
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; CA: CA: Continous Assessment

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:** 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 BuiltEnvironment 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 suchas 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, Guesthouse. **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, SportsClub; **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 Systemfor 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, Heatbalance 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 (assuming100 employees working in office, and 2 and 4wheeler are allowed) **Self-Learning:** : Prepare Security guard cabin and parking area for MNC Company (assuming 50 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 Continuous Assessment ensures the satisfactory performance of laboratory workand minimum passing marks in Continuous Assessment.
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 beconducted.

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)

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 (MonojitChakrabortiPublications, 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)

Universal Human Values												
Semester: III			Term: ODD				Course Code: 24CSVEC301B					
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; CA: Continuous Assessment

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		CO1

	• Programme to Ensure self-regulation and Health		
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

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

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.

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

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)

Useful Links:

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

Bachelor of Engineering

In

Civil Engineering

Third Year

Semester – V

SJCEM R-24C

Effective from Academic Year 2026-27

Program Structure for Third Year V Semester,

Civil Engineering

(With Effect from 2026-2027)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CEPCC501B	PCC	Transportation Engineering	3	-	2	3	-	1	4
24CEPCC502B	PCC	Reinforced Concrete	3	1	-	3	1	-	4
24CEPEC501XB	PEC	Professional Elective I	3	-	-	3	-	-	3
24CEPEC502XB	PEC	Professional Elective II	3	-	-	3	-	-	3
24OE501XB	OE	Open Elective I	3	-	-	3	-	-	3
24MDM501B	MDM	Multidisciplinary Minor	3	-	2	3	-	1	4
24CEVSE501B	VSEC	Employability Enhancement Program –2 (Basics of Pythons for Civil Engineers)	-	-	2	-	-	1	1
Total			**18**	**1**	**6**	**18**	**1**	**3**	**22**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE-I	IAE-II	ESE	TW	OR/PR	Total
24CEPCC501B	PCC	Transportation Engineering	20	20	60	25	25	150
24CEPCC502B	PCC	Reinforced Concrete	20	20	60	25	25	150
24CEPEC501XB	PEC	Professional Elective I	20	20	60	25	-	125
24CEPEC502XB	PEC	Professional Elective II	20	20	60	25	-	125
24OE501XB	OE	Open Elective I	20	20	60	-	-	100
24CEVSE501B	VSEC	Employability Enhancement Program –2 (Basics of Pythons for Civil Engineers)	10	10	30	25	-	75
Total			**110**	**110**	**330**	**100**	**50**	**725**

Professional Electives				
Sem	**Track 01 [Structural Engineering]**	**Track 02 [Environmental and Water Resource Engineering]**	**Track 03 [Transportation & Geotechnical Engineering]**	**Track 04 [Construction Engineering & Management]**
V Sem	Advanced Concrete Technology	Water Resource Engineering	Ground Improvement Techniques	Construction Productivity

Open Elective				
Course Name	Design Thinking	Research Methodology	Basic Competence Skills-I (BCS-I)	Basics of Marketing Management
Course Code	24OE5011B	24OE5012B	24OE5013B	24OE5014B

Transportation Engineering

Semester: V			Term: Odd				Course Code: 24CEPCC501B					
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	3	20	20	60	25	25	150

IAE: Internal Assessment Examination; ESE: End Semester, Examination, CA: Continuous Assessment

Course Objectives:

1. To introduce students to the evolution and classification of roads, development initiatives in India, and the process of highway alignment and project planning.
2. Introducing students to the various modes of transportation and selecting the best suited mode of transportation for various conditions
3. To impart knowledge of geometric design principles including cross-sectional elements, sight distance, and the alignment of highways for safe and efficient transportation.
4. To develop an understanding of traffic characteristics, studies, flow theory, and regulatory mechanisms to design efficient traffic systems and intersections.
5. To provide insights into the selection, properties, and testing of various pavement materials used in highway construction, with a focus on performance and durability
6. To equip students with the ability to design both flexible and rigid pavements in accordance with IRC guidelines, considering influencing factors and stress distribution.

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

1. Carry out surveys involved in planning and highway alignment
2. Able to identify the feasibility of mode of transportation system
3. Design the geometric elements of highways and expressways
4. Carry out traffic studies and implement traffic regulation and control measures and intersection design
5. Characterize pavement materials
6. Design flexible and rigid pavements as per irc

Module	Course Module / Contents	No of Hrs
1	**Highway development and planning:** Classification of roads, Road development in India, Current Road projects in India, Highway alignment and project preparation.	**05**

2	**Modes of transportation:** Introduction to Highway engineering, Merits & Demerits, Introduction to railway engineering and recent developments in railway engineering, Introduction to Airway, Merits & Demerits, Introduction to Waterway, Merits & Demerits	**05**
3	**Geometric design of highways:** Introduction; highway cross section elements & Sight distance, Design of horizontal alignment, Design of vertical alignment, Design of intersections	**10**
4	**Traffic engineering & control:** Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections, design of parking facilities; highway lighting; problems	**10**
5	**Pavement materials:** Materials used in Highway Construction- Soils, Stone aggregates, bituminous binder, Bituminous paving mixes; Portland cement and cement Concrete, Desirable properties, tests, Requirements for different types of pavements. Problems	**07**
6	**Design of pavements:** Introduction; flexible pavements, factors affecting design and Performance, stresses in flexible pavements; design of flexible pavements as per IRC, Rigid pavements- components and function, Factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems	**08**

Exp. No.	List of Experiments	CO Mapped
1	Impact test on aggregate	CO-05
2	Los Angeles abrasion test on aggregate	CO-05
3	Crushing strength of aggregate	CO-05
4	Combined index of aggregate	CO-05
5	Traffic Volume study (flow)	CO-04
6	Penetration Test on Bitumen	CO-05
7	Viscosity Test on Bitumen	CO-05
8	Softening Point Test on Bitumen	CO-05
9	Ductility Test on Bitumen	CO-05
10	Onsite Measurement of Super elevation and Camber	CO-03

Evaluation Scheme and Assessment:

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

Continuous Assessment (CA): CA should consist of 10 Experiments (Whichever is applicable)

Journal must include at least 05 assignments. The final certification and acceptance of term work ensures satisfactory performance of work and minimum passing marks in term work.

Total 25 Marks:

Activity learning	Attendance (Theory & Practical)	Assignments/Mind map/Case study/ GD/Solution for societal problems/ As per subject need and teacher preference
10 marks	05 marks	10 marks

Recommended Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
3. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning,
4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
5. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

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. Relevant specifications of MORTH and relevant IRC codes

Reinforced Concrete

Semester: V			Term: ODD				Course Code: 24CEPCC502B					
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	25	150

IAE: Internal Assessment Examination, ESE: End Semester Examination, CA: Continues Assessment

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 calculationin RCC structures.
5. To develop the concept of design using design charts and curves for columns subjected to axialload 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 use of readymade design charts and curves from Special Publications of Bureau of Indian Standards. Under LSM.
3. Analyze and design various reinforced concrete elements such as beam using the concept of Limit State Method.
4. Analyze and design various reinforced concrete elements such as Slab using the concept of Limit State Method.
5. Design of reinforced concrete element such as column using the concept of Limit State Method
6. Design of reinforced concrete element such as footings using 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. **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 slendercolumn. Introduction to Members subjected to combined axial and biaxial bending. **Self-Learning**:- Development of interactive curves and their use in column design.	08	CO-05
VI	**Design of Foundations:** Design of Isolated square and rectangular footings subjected to axial load and moment. **Self-Learning**: - Introduction to basic concepts of combined Footing.	06	CO-06

Sr. No.	List of Tutorial	CO
1	Concept of balanced, under reinforced and over reinforced sections.	1
2	Explain various limit states of collapse.	2
3	Design of singly reinforced Rectangular and Flanged sections for flexure	3
4	Design of doubly reinforced Rectangular andFlanged sections for flexure	3

5	Design of beam for shear and bond.	3
6	Design of simply supported one-way slabs as per IS:456-2000.	4
7	Design of simply supported two-way slabs as per IS:456-2000.	4
8	Design of Circular column	5
9	Design of rectangular column	5
10	Design of Isolated square and rectangular footings	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 Tutorials
2. Journal must include at least 05 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory workand 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 AgeInternational 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.

Advanced Concrete Technology

Semester: V			Term: ODD				Course Code: 24CEPEC5011B					
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; CA: CA: Continous Assessment

Course Objectives:

1. To understand the various properties and tests of materials used in concrete along with therheology of fresh concrete.
2. To study the different procedures for testing hardened concrete, its compositions and quality ofin 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 weatherconcreting.
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	10	01

	for concrete. **Aggregates:** Types of aggregate, required characteristics of aggregates for concrete, introduction to gradation of aggregates. **Chemical admixture:** Introduction to accelerators, retarders, plasticizers, superplasticizers, 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.		
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 ofcompression testing, tensile strength of concrete (split and flexural), relationship between compressive and tensile strength. **Advanced non-destructive evaluation:** Ground penetration radar, probe testpenetration, 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	06	03

	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.		
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 ofEnvironment (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	11	05

	reinforced concrete. **Self-Learning**: **Introduction to other special concrete** – Vacuum concrete, waste material-based concrete, shotcrete, roller compacted, mass concrete.		
VI	**Quality Control (QC)** Introduction: Statistical QC, quality factors, control charts. Acceptance criteriaaccording 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.

Continuous Assessment:

1. Continuous Assessment 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 Continuous Assessment ensures the satisfactory performance oflaboratory work and minimum passing marks in Continuous Assessment.
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

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.

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.

Useful Links

1. www.theconcreteportal.com

Water Resource Engineering

Semester: V			Term: Odd				Course Code: 24CEPEC5012B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	TW	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, CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. To study different irrigation engineering methods and water requirement of crops.
2. To study hydrological cycle, its elements and plotting of hydrographs.
3. To study and calculate discharge from aquifers.
4. To study control level fixation for reservoir, dams i.e., gravity dam, its various components and analysis and suitable conditions of earthen dam and its seepage analysis.
5. To study importance of silt theories and its design considerations.
6. To study Canal headwork, its distribution system and design of canal structures

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

1. Describe National water Policy, Calculate Crop water requirement and classify various types and methods of irrigation.
2. Estimate flood discharge and Runoff by traditional and modern usage tools for planning and management of water resources projects.
3. Apply knowledge on ground water, well hydraulics to estimate the safe yield and ground water potential
4. Analyze and design gravity dams and earthen dams with spillways for sustainable development
5. Compare different silt theories related to irrigation channel and design the same.
6. Classify and explain various canal structures and suggest remedial measures for water logging to save fertile irrigation.

Module	Contents	Hours	COs
I	**Introduction to basic Irrigation Methods and Water Requirement of Crops:** Introduction to irrigation and its need, Benefits of irrigation and its ill effects, types of Irrigation systems: surface, sub-surface, sprinkler and drip	08	1

	irrigation. Water Requirement of Crops: Crops and crop seasons in India, delta and duty of crops, relationship between delta and duty of crops. Soil water relationship and its significance from irrigation considerations, root zone soil water, infiltration, consumptive use, frequency of irrigation.		
II	**Hydrologic cycle and Precipitation:** Forms and Types of precipitations. Measurement of rainfall by rain gauges and stream flow measurement. Calculation of missing rainfall data and adequacy of rain gauge stations. Runoff: Runoff- factors affecting runoff, computation of runoff, yield of the catchment runoff hydrograph, flood discharge and its calculations; Hydrograph: Flood hydrograph- Its components and base-flow separation, Unit hydrograph, application of unit hydrograph, methods of deriving unit hydrograph, S-hydrograph and its application.	08	2
III	**Ground water and well hydrology: F**orms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.	06	3
IV	**Dams and Spillways:** Reservoir, various zones of storage reservoir, control level fixation for a reservoir. Introduction to reservoir sedimentation and control measures. **Gravity Dams**: Definition, typical cross section and components of gravity dam, forces acting on gravity dam, modes of failure of gravity dam, structural stability analysis of gravity dam, elementary and practical profile of gravity dam, low and high gravity dam, galleries in gravity dam – Function of gallery joints in gravity dam. Control of cracking in concrete dams. **Earthen Dam:** Types of earthen dams and methods of construction of earthen dam, causes and failures of earthen dams, seepage line/phreatic line for different conditions and its location using graphical method, seepage control through embankment and through foundations. **Spillways:** Introduction, types of spillways, its working and functionality.	10	4
V	**Irrigation Channels:** Kennedy's theory and method of channel designs silt supporting capacity according to Kennedy's theory. Lacey's regime theory	07	5

	and application of Lacey's theory for designing channel cross-section, Comparison between Kennedy's theory and Lacey's theory. Drawbacks of Kennedy's theory and Lacey's theory. Introduction to sediment transport in channels.		
VI	**Canal Headwork-Distribution System and Canal Structures:** Canal Headwork and Distribution System: Classification of canals, canal alignment, canal losses, canal lining, water logging and remedial measures for water logging.; Canal Structures, Canal Falls and its types, canal escapes and types of canal escapes, canal regulators and types of canal regulators, canal outlets and types of canal outlets, cross drainage works and types of cross drainage work.	06	6

Sr. No	List of Tutorials (Any Five)	CO Mapping
1	Irrigation projects in India and Numerical based on Water requirement of crops.	1
2	Numerical based on missing data, hydrographs.	2
3	Numerical based on yield of aquifer.	3
4	Numerical based on stability of gravity dam, seepage line (earthen dam)	4
5	Numerical based on Silt Theories	5
6	Case study on different canals in India and abroad.	6
7	Prepare a model for any one water distribution technique referring to introductory chapter.	1
8	Prepare model for Dam (Gravity or Earthen Dam).	4

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
10 marks	05 marks	10 marks

Reference Books:

1. Irrigation and Water Power Engineering: B.C. Punmia, PandeB.B.Lal, A.K Jain. Laxmi Publications Pvt, Ltd. New Delhi.
2. Irrigation Engineering and Hydraulic Structures: S.K. Ukarande, Ane Books Pvt. Ltd. ISBN-9789383656899.
3. Irrigation Water Resources and Water Power Engineering: P.N. Modi, Standard Book House, Delhi, ISBN 978-81-87401-29-0.
4. Irrigation Engineering and Hydraulics Structures: S. K. Garg, Khanna Publishers. Delhi.
5. Design of Irrigation Structures: S. K. Sharma, S. Chand and Co.

Ground Improvement Techniques

Semester: V			Term: Odd				Course Code: 24CEPEC5013B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	TW	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, CA: Continuous Assessment, TW: Term Work

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.

Outcomes

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

1. Identify the problems associated with the existing ground conditions and recognize the need for ground improvement.
2. Explain shallow and deep compaction techniques, pre-compression and vertical drains as well as 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 of anchors.

Module	Course Module/ Contents	Periods
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,	08

	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, equipments 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.) **Note:** Refer IS 13094 (1992): "Selection of ground improvement techniques for foundation in weak soils – Guidelines"	
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; 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; Electrokinetic stabilization	**06**
IV	**Grouting** 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.	**07**

	Note: Refer 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 **Note:** Refer 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; Introduction to soil nailing and ground anchors; Capacity of shallow horizontal strip anchor by using Mononobe-Okabe method.	**08**

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.

Construction Productivity

Semester: V			**Term: Odd**				**Course Code:** 24CEPEC5014B					
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; CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. To introduce the concept of productivity in construction, highlighting its importance and impact on cost and project duration.
2. To equip students with knowledge of productivity measurement techniques.
3. To familarize students with knowledge of lean construction principles.
4. To develop practical skills in field productivity assessment
5. To introduce students with the productivity improvement techniques.
6. To provide hands-on experience with digital tools and software.

Course Outcomes:

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

1. Explain the concept of productivity and its influence on construction project performance, using case-based examples.
2. Measure and interpret productivity metrics for labor and equipment.
3. Apply Lean Construction concepts to distinguish between value-adding and non-value-adding activities and enhance project workflows.
4. Conduct field productivity assessments using techniques like work sampling, time analysis, and foreman delay surveys.
5. Familiar with the productivity improvement techniques.
6. Utilize construction software to analyze site productivity and interpret data

Module	Contents	Hours	COs
I	**Fundamentals of Productivity in Construction** • Definition of Productivity: Concept, importance, and relevance in construction. • Impact on Construction Duration & Cost: How productivity influences project timelines and financial outcomes. • Factors Affecting Productivity: Materials, equipment, labor efficiency, weather conditions, and management practices. • Case Studies: Real-world examples of productivity challenges in construction projects.	07	1

II	**Measuring Productivity in Construction** • Productivity Metrics for Construction Equipment: Measuring performance, cycle time, and efficiency. • Staff & Labor Productivity: Key benchmarks and industry standards for workforce productivity. • Productivity Analysis from Daily Progress Reports: Techniques for tracking and evaluating productivity trends. • Benchmarking & Improvement Strategies: Comparison with industry best practices.	07	2
III	**Lean Construction Concepts** • Introduction to Lean Construction: Principles and objectives. • Value-Adding Activities vs. Non-Value-Adding Activities: Identifying areas for optimization. • Non-Value-Adding but Necessary Activities: Understanding unavoidable constraints. • Lean Strategies for Enhancing Efficiency: Practical applications in project management.	07	3
IV	**Field Productivity Measurement Techniques** • Work Sampling: Observational methods for assessing efficiency. • Takt Time Analysis: Synchronizing work pace to reduce delays. • Foreman Delay Surveys: Identifying bottlenecks through structured assessments. • Data Collection & Interpretation: Using analytics to enhance productivity.	08	4
V	**Productivity Improvement Methods** • Value Stream Mapping (VSM): Visualizing workflows to identify inefficiencies. • Location-Based Management Systems: Optimizing project sequencing and resource allocation. • 5S Methodology & Good Housekeeping Practices: Organizing construction sites for efficiency. • Implementation Frameworks: Steps to integrate improvement measures into projects.	08	5
VI	**Specialist Software for Productivity Studies** • Introduction to Digital Tools for Productivity Analysis: Overview of construction-focused software. • Vico Software for Productivity Studies: Features, applications, and case studies. • Integration of Digital Solutions in Lean Construction: How technology enhances efficiency.	08	6

	• Hands-on Session & Practical Applications: Demonstration and exercises with software tools.		

Sr. No.	List of Tutorials	CO Mapping
1	Productivity Case Study Analysis	1
2	Factors Affecting Site Productivity – Group Discussion	1
3	Productivity Metrics – Calculation Exercises	1
4	Lean vs. Traditional Construction Methods – Comparative Study	1
5	Lean Construction Activity	2
6	Work Sampling Exercise	2
7	Productivity Loss Analysis	3
8	Daily Progress Report Evaluation	3
9	Productivity improvement techniques	6
10	Integration of Digital Solutions in Lean Construction	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.

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:

Tutorial	Attendance	Assignments
10 marks	05 marks	10 marks

Reference Books:

1. Construction Management and Planning by B. Sengupta and H. Guha
2. Construction Project Management: Theory and Practice by K.K. Chitkara
3. Construction Engineering and Management by S. Seetharaman

Text Books:

1. Lean Construction Management: The Toyota Way by Shangareddy Ramesh
2. Construction Planning, Equipment and Methods by R.L. Peurifoy, T.R. Sharma

Design Thinking												
Semester: V			**Term:**				**Course Code: 24OE5011B**					
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	25	-	125

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

Course Objectives:

1. To introduce a learner to the principles of Design Thinking
2. To familiarize a learner with the process (stages) of Design Thinking
3. To expose a learner to various case studies of Design Thinking

Course Outcomes:

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

1. To compare traditional approach to problem solving with the Design Thinking approach and discuss the principles along with the process of Design Thinking
2. To define a user persona using Empathy Mapping
3. To frame a problem statement using various Design Thinking tools
4. To select best idea among the ideas generated through various Design Thinking tools
5. To create prototypes using engineering principles
6. To test the prototypes and gather feedback for refining the prototype

Module	Contents	Hours	COs
I	**Introduction to Design Thinking**	6	CO1
	Definition, comparison of traditional approach with Design Thinking, process (stages) of Design Thinking, case studies		
II	**Creating User Persona**	8	CO2
	Interview technique, user observation technique, creation of empathy map		
III	**Defining problem statement**	8	CO3
	Cause and effect, mind mapping and journey maps technique		
IV	**Ideation**	8	CO4
	Brain storming, Bench marking and prioritizing technique		
V	**Prototype generation**	8	CO5
	Rules of prototype generation, Low and high-fidelity prototypes, Prototyping techniques - Paper, Digital and 3D prototyping		
VI	**Testing the prototype**	7	CO6
	Evaluation techniques: Interviews, User observation, Wireframing, A/B Testing		
	Total	**45**	

Sr. No.	Suggested Experiment List	COs
1.	Conducting user interviews and observations for a specific product or system to identify user pain points. Prepare an empathy map.	CO1
2.	Developing detailed user personas based on their empathy research.	CO2
3.	Synthesizing the findings from user research to define a clear problem statement in engineering terms.	CO3
4.	Performing a brainstorming session withing the group using mind mapping techniques to generate creative solutions to the defined problem.	CO4
5.	Creating a prototype for selected idea using engineering principles. Prototype could be a physical model, electronic circuits, web or mobile app or a combination of these.	CO5
6.	Testing the prototype with the users and gathering feedback to created refined prototype.	CO6

Evaluation Scheme and Assessment:

A. Internal Assessment Examination:

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:

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

D. 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. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

E. Oral & Practical Exam

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

Reference Books:

1. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, Idris Mootee, Wiley, 2013
2. Change by Design, Tim Brown, Harper Business, 2009

Text Books:

1. Design Thinking: Methodology Book, Emrah Yayichi, 2016
2. Handbook of Design Thinking: Christian Mueller-Roterberg, 2018

Useful Links:

1. Empathy map https://www.nngroup.com/articles/empathy-mapping/
2. Prototyping
   https://staragile.com/blog/prototype-in-design-thinking
3. Design Thinking case studies
   https://voltagecontrol.com/blog/8-great-design-thinking-examples/ https://dyworks.in/design-thinking-case-studies/

Research Methodology												
Semester: V			**Term:** Even				**Course Code: 24OE5012B**					
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	-	-	3	-	-	3						

IAE: Internal Assessment

Examination ESE: End Semester

Examination

CA: Continuous Assessment

Course Objectives:

1. Understand the fundamental concepts of research including constructs, hypotheses, propositions, **CO2**: Differentiate among various types of research and apply appropriate research
2. Design effective
3. Apply the stages of the scientific research process from problem identification to report writing.
4. Formulate a relevant and feasible research problem considering key practical factors such as data availability and interpretation.
5. Evaluate research outcomes critically, test validity, and address ethical issues while presenting actionable recommendations.

Course Outcomes:

1. Fundamental research concepts such as constructs, hypotheses, postulates, and distinguish
2. Identify and differentiate various types of research (e.g., basic, applied, analytical, empirical)
3. Develop an appropriate research and sample design, identifying stages and techniques, and recognize potential sampling errors.
4. Apply the scientific research process, from selecting a research problem to preparing the final report, including data collection, analysis, and hypothesis testing
5. Formulate a relevant and feasible research problem
6. Evaluate research outcomes by testing validity, addressing ethical issues, and proposing practical recommendations based on findings

Module	Contents (All Modules are hands on only)	Hours	COs
I	Module 1: Introduction and Basic Research Concepts Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research, Issues and Problems in Research, Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	10	1

II	**Module 2: Types of Research** Basic Research, Applied Research, Descriptive Research, Analytical Research, Empirical Research, Qualitative and Quantitative Approaches	8	2
III	**Module 3: Research Design and Sample Design** Research Design – Meaning, Types and Significance, Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	8	3
IV	**Module 4: Research Methodology** Meaning of Research Methodology ,Stages in Scientific Research Process: Identification and Selection of Research Problem, Formulation of Research Problem, Review of Literature, Formulation of Hypothesis, Formulation of research Design, Sample Design , Data Collection, Data= Analysis, Hypothesis testing and Interpretation of Data, Preparation of Research Report	6	4
V	**Module 5: Formulating Research Problem** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	8	5
VI	**Module 6: Outcome of Research** Preparation of the report on conclusion reached, Validity Testing & Ethical Issues, Suggestions and Recommendation	5	6

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. Uma Sekaran & Roger Bougie, Title: *Research Methods for Business: A Skill Building Approach,* Publisher: Wiley Donald R. Cooper & Pamela S. Schindler Title: *Business Research Methods* Publisher: McGraw Hill, Zikmund, Babin, Carr & Griffin Title: *Business Research Methods* Publisher: Cengage Learning

Text Books:

1. C.R. Kothari & Gaurav Garg, Title: *Research Methodology: Methods and Techniques* Publisher: New Age International Publishers
2. Ranjit Kumar, Title: *Research Methodology: A Step-by-Step Guide for Beginners*, **Publisher**: SAGE Publications

Basic Competence Skills-I (BCS-I)												
Semester: V			Term: ODD			Course Code: 24OE5013B						
Teaching Scheme						Evaluation Scheme:						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA/TW	OR/PR/ TU.	Total
TH	TU	PR	TH	TU	PR							
3	-	-	3	-		3	20	20	60	-	-	100

Course Objectives:

1. To enhance the linguistic abilities of students aiming for international education.
2. To prepare learners for English proficiency tests like IELTS.
3. To develop listening, speaking, reading, and writing (LSRW) skills essential for academic and professional success.
4. To guide students in navigating the complete study abroad journey including documentation, interviews, grooming and cultural readiness.

Course Outcomes:

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

1. Understand the nature of IELTS and build a strong academic vocabulary and apply correct grammatical structures in English.
2. Understand and apply test-taking strategies specific to IELTS.
3. Demonstrate improved proficiency in LSRW through structured practice.
4. Participate confidently in mock interviews, aptitude tests, academic and professional discussions.
5. Draft key documents like SOPs, resumes, and visa applications.
6. Understand the procedures and cultural aspects of studying abroad, including visa and immigration protocols.

Module	Main Topic	Hours	COs
1	**Module 1: Introduction to IELTS and Vocabulary Building for International Education** • Overview of IELTS: Academic vs General Training • Scoring system and band descriptors • Global university requirements and score expectations • Study abroad roadmap: Exams, applications, visas, arrival **Vocabulary Building** Academic and topic-based vocabulary, context-based usage, collocations, Synonyms, and word families	05	CO1
2	**Module 2: IELTS Listening Skills** • Section-wise strategies, note-taking techniques, mock listening tests with feedback • Practice with audio material	10	CO2

3	**Module 3: IELTS Reading Skills** • Skimming, scanning, and reading for detail • Handling complex vocabulary and sentence structures • Dealing with True/False/Not Given and matching-type questions • Practice passages with discussion	10	CO3
4.	**Module 4: IELTS Writing Skills (9 hours)** • Task: 1 (Academic & General), • Task: 2 (Essays), structure and coherence, vocabulary enhancement, peer reviews • Task: 3 Resume, SOP and LOR drafting.	10	O4
5	**Module 5: IELTS Speaking Skills with Personality Development & Grooming** • Understanding the structure: Introduction, long turn, discussion • Developing fluency, coherence, and lexical resource • Pronunciation and stress practice • Mock interviews and role-plays • Confidence building and body language • Professional communication and etiquette • Dress code for interviews and visa appointments	08	CO5
6	**Module 6: Study Abroad Process & Immigration Readiness** • Visa application essentials: documents, timelines, interviews • Financial planning and scholarships • Cultural preparation and soft-landing tips • Avoiding immigration fraud/scams	02	CO6

Teaching Methodology

- Interactive lectures
- Audio-visual aids (for Listening & Speaking modules)
- Practice Tests & Mock Sessions
- Peer Review Workshops
- Group Discussions & Role-Plays
- Guest Lectures (Study Abroad Experts) Online/Offline

Examination Scheme:

IAE I 20 Marks based on Introduction to IELTS and Vocabulary Building for International Education

(WRITTEN TEST)

IAE II 20 Marks based on IELTS Speaking Skills/ Study Abroad Process & Immigration Readiness/ (ORAL TEST)

ESE 60 Marks based on IELTS Reading/IELTS Writing -40 Marks (Written Paper)
IELTS Listening TEST -20 Marks to be conducted separately

Reference Books and Materials:

1. The Official Cambridge Guide to IELTS – Cambridge University Press

2. Barron's IELTS Superpack – Published by Barron's (available via Galgotia Publications in India)
3. Collins English for IELTS Series – Covers Reading, Writing, Listening, and Speaking (Collins)
4. Cambridge IELTS Practice Tests (Books 10 to 18) – Cambridge University Press
5. Word Power Made Easy by Norman Lewis – A classic vocabulary builder
6. English Grammar in Use by Raymond Murphy – Cambridge University Press
7. Personality Development and Soft Skills by Barun K. Mitra – Oxford University Press India
8. Online articles and editorials from The Hindu and BBC Learning English – For developing current affairs awareness and vocabulary
9. TED Talks – For exposure to diverse topics and presentation styles
10. IELTS Liz and IELTS Simon – Free, high-quality online resources for IELTS tips and practice

Recommended TED Talks for IELTS Training

1. "The Power of Vulnerability" – *Brené Brown:* Great for understanding narrative structure and personal storytelling (useful in Speaking Part 2).
2. "Your Body Language May Shape Who You Are" – *Amy Cuddy:* Excellent for non-verbal communication; ties into grooming and confidence.
3. "How to Speak So That People Want to Listen" – *Julian Treasure:* Perfect for improving speech clarity, tone, and presence (Speaking Section focus).
4. "Do Schools Kill Creativity?" – *Sir Ken Robinson:* A compelling talk that uses humor and logic — useful for note-taking practice.
5. "The Danger of a Single Story" – *Chimamanda Ngozi Adichie:* Strong in structure and vocabulary; ideal for understanding cultural perspectives.
6. "Why Do We Sleep?" – *Matt Walker:* Great for practicing understanding of complex ideas and academic-style content (Listening + Reading).
7. "The Art of Stillness" – *Pico Iyer:* Calming delivery style; teaches students how to listen actively and reflect.
8. "What Makes a Good Life?" – *Robert Waldinger:* A data-backed talk that mirrors academic writing tone and structure.
9. "Inside the Mind of a Master Procrastinator" – *Tim Urban:* Engaging, informal tone to explore transitions in speech and humor in storytelling.
10. "This Is What Happens When You Reply to Spam Email" – *James Veitch:* Light, witty tone that can help with understanding sarcasm and irony in English

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 10 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 30 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. Flipped 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.

Reference Books:

1. Mark Lutz – Learning Python, O'Reilly, 5th Edition
2. Luciano Ramalho – Fluent Python, O'Reilly, 2nd Edition
3. Wes McKinney – Python for Data Analysis, O'Reilly

Text Books:

1. Python Cookbook by David Beazley and Brian K. Jones
2. Effective Python by Brett Slatkin
3. Automate the Boring Stuff with Python by Al Sweigart

Useful Links:

1. NPTEL – Python for Data Science
2. NPTEL – Programming in Python
3. CS50's Web Programming with Python and JavaScript – Harvard

Basics of Marketing Management												
Semester: V			**Term: ODD**				**Course Code: 24OE5014B**					
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	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment
Examination ESE: End Semester
Examination
CA: Continuous Assessment

Course Objectives:

1. To introduce basic concepts and functions of marketing.
2. To help students understand consumer behavior and market segmentation.
3. To familiarize students with product, pricing, promotion, and distribution strategies.
4. To provide an understanding of modern marketing trends including digital and green marketing.
5. To enable engineering students to apply marketing principles in technology-driven environments.

Course Outcomes:

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

1. Define key marketing terms and explain the role of marketing in organizations...
2. Analyze consumer behavior and segment markets effectively
3. Apply the marketing mix (4Ps) in real-world scenarios.
4. Evaluate marketing strategies using SWOT and competitor analysis.
5. Identify and explain emerging marketing practices such as digital, green, and social marketing.
6. Integrate basic marketing knowledge into engineering projects and innovations.

Module	Contents	Hours	COs
I	**Introduction to Marketing**	**06**	CO1
	Definition, nature, scope, and importance of marketing; Core marketing concepts: Needs, Wants, Demand, Value, Exchange Evolution of marketing: Production to Relationship orientation Role of marketing in business and society **Self-learning Topic:** Case Study Analysis – How Apple Uses Marketing to Create Customer Value		
II	**Understanding the Market and Consumer Behavior**	08	CO2
	Marketing environment: Micro and Macro Buyer decision process – stages and influencing factors Market segmentation: Bases and strategies		

	Targeting and Positioning (STP) **Self-learning Topic:** Consumer Behavior Models (e.g., AIDA, Maslow's Hierarchy) and Their Real-World Applications		
III	**Marketing Mix - Product and Price**	08	CO3
	Product: Levels, types, lifecycle, new product development Branding, Packaging, and Labeling; Pricing: Objectives, strategies, and methods Factors affecting pricing decisions **Self-learning Topic:** Skimming vs. Penetration Pricing – Strategies Used by Tech Startups		
IV	**Marketing Mix - Place and Promotion**	08	CO4
	Distribution channels: Types and functions retailing, Wholesaling, and Logistics; Promotion mix: Advertising, Sales Promotion, Public Relations, Direct Marketing, Personal Selling Integrated Marketing Communication (IMC) **Self-learning Topic:** Role of Influencer Marketing in Brand Promotion		
V	**Strategic Marketing and Modern Trends**	**08**	CO5
	SWOT analysis and marketing planning BCG Matrix, Ansoff Matrix, Digital Marketing: SEO, SEM, Social Media Marketing, Email Marketing, E-commerce and m-commerce strategies **Self-learning Topic:** Google Ads vs. Social Media Ads – ROI Comparison and Strategy Design		
VI	**Social Responsibility and Applications of Marketing**	07	CO6
	Green marketing and sustainability Ethical issues in marketing; Rural marketing in India Applying marketing principles to engineering innovations/ startups. **Self-learning Topic:** Marketing Strategies for Rural India – Case of Patanjali or Amul		
	Total	**45**	

Suggested Activities and Mini Project:

1. Case study analysis on marketing strategies of tech companies
2. Group presentation on digital marketing tools
3. Survey-based project on consumer behavior for a product
4. Role-play for product launching and branding
5. Design a basic marketing plan for an engineering project/startup

Evaluation and Assessment Scheme:

Internal Assessment Examination:

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.

End Semester Theory Examination:

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

Reference Books:

1. S.A. Sherlekar, Marketing Management, Himalaya Publishing.
2. Grewal & Levy, Marketing, McGraw-Hill Education.
3. Tracy L. Tuten, Principles of Marketing for a Digital Age, SAGE Publications.

Text Books:

1. Philip Kotler, Marketing Management, Pearson Education.
2. Ramaswamy & Namakumari, Marketing Management: Global Perspective Indian Context, Macmillan..

Basics of Python for Civil Engineering												
Semester: V			Term: ODD				Course Code: 24OE5014B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	O/ Tu/Pr	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

The course "Basics of Python for Civil Engineering" equips students with essential programming skills to analyse, compute, and visualize engineering data. Python's simplicity and powerful libraries like NumPy and Matplotlib make it ideal for solving Civil Engineering problems such as structural analysis, soil testing, and hydrological studies. This course bridges programming with practical applications, enhancing problem-solving and preparing students for modern engineering challenges.

Course Objectives

The course aims to:

1. Introduce students to the fundamentals of Python programming and its importance in solving Civil Engineering problems.
2. Develop logical thinking through the use of control structures, functions, and data structures.
3. Enable students to handle engineering data effectively using file handling and string manipulation.
4. Equip students with computational skills using NumPy for numerical and matrix operations relevant to Civil Engineering applications.
5. Familiarize students with visualization tools for representing engineering data through plots and charts.
6. Apply Python programming for practical Civil Engineering problems such as structural analysis, soil mechanics, hydraulics, and material testing.

Course Exit Outcomes

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

1. Explain the role of Python programming in Civil Engineering and demonstrate basic coding skills.
2. Apply control structures and functions to solve engineering-related problems.
3. Utilize Python data structures and file handling techniques for storing, processing, and retrieving engineering data.
4. Perform numerical computations and matrix operations using NumPy.
5. Create effective plots and visualizations to analyse and interpret Civil Engineering data.

6. Implement Python-based solutions for Civil Engineering applications such as soil tests, structural plots, and water resources analysis.

Module	Content	Hours	COs
1	**Introduction to Python** Importance of Programming in Civil Engineering; Python Overview, IDEs (Google Colab), Environment Setup; Variables, Data Types (int, float, string, bool)	2	1
2	**Control Structures and Functions** if, elif, else, for, while loops; Defining functions, scope of variables	3	2
3	**Data Structures and File Handling** Lists, Tuples, Sets, Dictionaries, File I/O – Reading/Writing CSV files, String operations	2	3
4	**Numerical & Scientific Computation** NumPy: arrays, matrix operations, Functions: linspace, arange, mean, std, dot, cross	2	4
5	**Data Visualization and Plotting** Matplotlib: line, bar, scatter, histogram, Plotting load vs deflection, rainfall vs time, etc.	3	5
6	**Applications in Civil Engineering** Various Calculations, Plots for yield test, sieve analysis, Mohr circle, liquid limit graph, OMC & MDD etc.	3	6

Sr. No	Practical/Experiments	CO
1.	Write programs to demonstrate variable assignments and basic data types (int, float, string, bool).	1
2.	Simple arithmetic operations related to Civil Engineering (e.g., unit conversions, area/volume calculations).	1
3.	Write a program using if-elif-else to check soil classification based on liquid/plastic limits.	2
4.	Use loops to generate multiplication tables for reinforcement bar lengths.	2
5.	Write a function to calculate the factor of safety given input parameters.	2
6.	Store rainfall data in lists and compute monthly averages.	3
7.	Use dictionaries to map soil types to permeability values.	3
8.	Read and write experimental test results (CSV files) such as sieve analysis data.	3
9.	Perform matrix operations for solving a system of linear equations (e.g., truss analysis).	4

10.	Calculate mean, standard deviation of compressive strength data.	4
11.	Use dot and cross functions for force vector calculations.	4
12.	Plot load vs deflection curve from experimental data.	5
13.	Plot histogram of cement compressive strength test values.	5
14.	Plot rainfall vs time line graph for hydrology data.	5
15.	Program to generate Mohr's circle for given stress conditions.	6
16.	Plot grain size distribution curve from sieve analysis data.	6
17.	Draw compaction curve (OMC & MDD) using experimental data.	6
18.	Plot flow net representation using simple coordinates.	6

Bachelor of Engineering
In
Civil Engineering

Final Year
Semester – VII

SJCEM R-24B

Effective from Academic Year 2026-27

Program Structure for Final Year VII Semester, Civil Engineering
(With Effect from 2026-2027)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CEPCC701B	PCC	Design & Drawing of Reinforced Concrete Structures	3	1	-	3	1	-	4
24CEPCC702B	PCC	Quantity Survey, Estimation and Valuation	3	1	-	3	1	-	4
24CEPCE701XB	PCE	Professional Elective V	3	-	-	3	-	-	3
24CEPCE702XB	PCE	Professional Elective VI	3	-	-	3	-	-	3
ILOC70XB	OE	Open Elective -II	3	-	-	3	-	-	3
24CEVSEC701B	AEC	Employability Enhancement Program-IV (Corporate Communication and Employability Skill)	-	-	2	-	-	1	1
24CEPRJ701B	PRJ	Capstone Project	-	-	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
24CEPCC701B	PCC	Design & Drawing of Reinforced Concrete Structures	20	20	60	25	-	125
24CEPCC702B	PCC	Quantity Survey, Estimation and Valuation	20	20	60	25	-	125
24CEPCE701XB	PCE	Professional Elective V	20	20	60	25	-	125
24CEPCE702XB	PCE	Professional Elective VI	20	20	60	25	-	125
ILOC70XB	OE	Open Elective -II	20	20	60	-	-	100
24CEVSEC701B	AEC	Employability Enhancement Program-IV (Corporate Communication and Employability Skill)	-	-		25	-	25
24CEPRJ701B	PRJ	Capstone Project	-	-	-	50	25	75
Total			**100**	**100**	**300**	**125**	**25**	**700**

Professional Electives				
Sem	Track 01		Track 02	
	Structural Engineering	Transportation & Geotechnical Engineering	Environmental and Water Resource Engineering	Construction Engineering & Management
VII Sem	Industrial Structures	Pavement Material & Design	Industrial Waste water Management	Construction Project Planning Systems.
Course Code	24CEPEC7011B	24CEPEC7012B	24CEPEC7021B	24CEPEC7022B

Open Elective Courses

Semester \ Track	Track 1 : Entrepreneurship	Track 2: Research Methodology	Track 3: Foreign Language	Track 4 : Business Management
Sem VII	Finance and Accounting	Intellectual Property Rights	Foreign Language-III (French)	Basics of HR Management

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, CA: Continues Assesment

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

1. To explain the concepts in the design of Staircase
2. To explain the LSM design procedure of 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 earthquake resistant design approach.
6. To introduce prestressed concrete.

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 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. Evaluate the response of structure during an earthquake and calculate design forces.
6. To introduce prestressed concrete.

Module	Contents	Hrs	COs
I	**Design of Staircase:-** Designof Dog legged Staircase and Open well Staircase. **Self-Learning;-** Study of Reinforcement details of staircase.	07	CO-01
II	**Design of Building**: Design of Slabs (One way and Two way with continuity), Beams (Simply supported, Continuous), Load transfer mechanism, arrangement of beams and columns. **Self Learning;-** Combined Footings	12	CO-03
III	**Design of retaining wall:-** Design of Cantilever retaining wall and Design of Counterfort retaining wall	09	CO-04

	Self Learning;- Study of reinforcement of Retaining Wall		
IV	**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 of elevated water tank.	09	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. **Self Learning:-** Earthquake loading	05	CO-05
VI	**Introduction to Pre-stressed Concrete** Prestressed Concrete: basic principles of prestressed concrete, systems ofprestressing. Losses in prestress. **Self Learning:-** Required Material for prestressed concrete.	03	CO-06

Sr. No.	**List of Tutorial**	**CO**
1	Designof Dog legged Staircase	1
2	Design of Slabs (One way and Two way with continuity),	2
3	Design of of Continues beams and long columns	2
4	Design of of long columns	2
5	Design of Cantilever retaining wall	3
6	Design of Counterfort retaining wall	3
7	Design of circular water tanks resting on ground	4
8	Design of rectangular water tanks resting on ground	4
9	Design load calculation by seismic coefficient method.	5
10	Different losses in prestress concrete	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.

Continues Assessment:

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 oflaboratory 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 InternationalPublications.
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: 24CEPCC702B					
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, CA: CA: Continous Assessment

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	Importance of Course, Measurement systems for specific items of civil engineering structures, Units of measurement of various items of works. **Self-learning:** Introduction, deduction rules for Masonry & Plastering work.	04	01

II	**Specifications & Rate Analysis:** Types & importance of specifications, rules to be followed for draftingthe specifications of important items of work etc. Rate analysis, its importance & necessity, Factors affecting rate analysis, Task work, sources of materials, Study of IS 7272 regardinglabor output. **Self-learning:** District Schedule of Rates (DSR) Rate analysis of important items of construction works.	07	02
III	**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. 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 suchas 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 structural elements 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. 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 ofthe 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.

Continuous Assessment:

1. Continuous Assessment 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 Continuous Assessment ensures the satisfactory performance oflaboratory work and minimum passing marks in Continuous Assessment.
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

Text Books:

1. World Bank approved contract documents

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

Pavement Materials, and Design

Semester: VII			Term: ODD			Course Code: 24CEPCE7012B						
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
	Soil		
	1.1	Soil-Classification methods	

I	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.	06
	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
		Methods of selection of suitable ingredient for super pave method, Gyratory compaction, rolling thin film oven, pressure aging vessel,	

	6.1	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 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. Highway Engineering: *Khanna, S.K., Justo, C,E.G. and Veeraragavan, A.,*Nem Chand andBrothers, 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 HillPublications, 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

Industrial Waste Treatment

Semester: IV			Term: Even			Course Code:24CEPCE8012					
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	-	-	3	-	-	3	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. *Understand industrial wastewater sources, impacts, and regulations.*
2. *Analyze effluent standards, water quality, and Streeter-Phelps oxygen balance.*
3. *Explore wastewater reduction and treatments like neutralization and coagulation.*
4. *Learn biological and advanced methods, including sludge dewatering and Ozonation.*
5. *Study industrial effluents, byproduct recovery, and ETP design.*
6. *Review legal frameworks, environmental audits, and CETP case studies.*

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

1. *Analyze industrial wastewater impacts, characterize contaminants, and calculate population equivalence.*
2. *Apply the Streeter-Phelps equation for effluent impact assessment and pollution control.*
3. *Recommend chemical and physical methods to reduce wastewater volume and strength.*
4. *Evaluate biological and advanced treatments, including sludge dewatering and innovative technologies.*
5. *Assess industrial wastewater management, focusing on ETPs, flow-sheets, and byproduct recovery.*
6. *Perform environmental audits, impact assessments, and optimize CETP operations.*

Module	Contents	Hrs	COs
I	**Introduction to industrial waste and treatments:** Sources and types of industrial waste-water, Effects of industrial waste-water on streams and waste-water treatment plants. Population equivalence, generation rates, characterization, important contaminants of concern from industries. Regulation for protection of streams. BOD Numerical. **Self-Study:** Toxicity and Bioassay tests	07	CO01
II	**Stream Protection Measures:** Stream and effluent standards, stream sampling, stream sanitation, Procedures for improving stream water quality, zones of pollution, oxygen sag curve, Streeter Phelps Equation and numerical. **Self-Study:** Additional Numerical for practices	08	CO-02
III	**Waste minimization:** Minimizing effects of industrial waste water: Volume reduction and Strength reduction; Equalization, Neutralization, Proportioning, Precipitation, Coagulation and flocculation. **Self-Study:** Flotation - Oil separation and Emulsion breaking.	07	CO-03

IV	**Waste-water treatments for industries** **Biological treatments:** Aerobic and Anaerobic biological treatment methods (Ponds, lagoons, UASB, RBC). Sludge dewatering techniques- Filter Press, Vacuum Filtration, Sludge thickening, Membrane filtration and Centrifuge. **Advanced treatments:** Need for advance technologies; Automated Chemostat Treatment (ACT); Soil Biotechnology (SBT); Reed Bed Technology (RBT); **Self Study:** Ozonation	8	CO-04
V	**Industries and Waste-Water Management:** Raw material, Manufacturing process and flow-sheets, sources of effluents, characteristics, ETP, byproduct recovery for following industries: Sugar, Distillery, Tannery, Dairy, Paper and Pulp, Metal Processing Industry (Electroplating) **Self Study:** Plastic Industries	09	CO-05
VI	**Legal Aspects, Environment Management Tools and Common** **Treatment Facility for industries:** Environmental Impact Assessment, Environmental Audit for industries; Common Effluent Treatment Plants (CETPs): Flow chart, Location, Need, Operation & Maintenance Problems and Economical aspects. **Self Study:** Case study.	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.

Term work: Students have to submit min one assignment or activity report in each module conducted in class. TW will be for 25 marks.

Recommended Books:

1. Industrial Pollution Control by Eckenfedlar W.W, 2017
2. Wastewater Engineering Treatment, Disposal, Refuse: Metcalf and Eddy, T.M.H. Edition, New Delhi, 1995.
3. Environmental Engineering Vol II- Sewage Disposal and Air Pollution Engineering: S. K. Garg, Khanna Publishers New Delhi.
4. Water supply and sanitary Engineering: Hussain S. K., Oxford and IBH Publication, New Delhi.
5. Wastewater Treatment for Pollution Control and Reuse Hardcover – 1 July 2017, Soli. J Arceivala , Shyam. R Asolekar.
6. Environmental Engineering: B. C. Punmia, Laxmi Publications, New Delhi.
7. Water Supply and Sewerage: E.W. Steel.

8. Introduction to Environmental Engineering, Vesilind, PWS Publishing Company 2000.
9. Introduction to Environmental Engineering: P. Aarne Vesilind, Susan M. Morgan, Thompson.
10. Wastewater Treatment- Concepts and Design Approach: G. L. Karia and R. A. Christian.
11. Basic Principles of Wastewater Treatment Book ,Marcos Von Sperling
12. Industrial Waste Water Treatment Book, A. D. Patwardhan
13. Waste Water Treatment, M.N. Rao and Dutta

Reference Books:

1. Manual on Wastewater Treatment 3rd Ed. Pub: CPH and Env. Engg. Organization,
2. Ministry of Urban Development, Govt. of India, New Delhi, 1991.
3. CPHEEO Manual on Sewage and Treatment.
4. Relevant Indian standard specifications and BIS publications.
5. Handbook of Water and Wastewater Treatment Plant Operations Book,y Frank R. Spellman

Construction Project Planning Systems.

Semester: IV			Term: Even			Course Code:24CEPCE8012					
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	-	-	3	-	-	3	20	20	60	25	-	125

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

***Course Objectives* - To achieve the above course outcome, the following Course Objectives are set:**

1. Introduce the project life cycle, stakeholder roles, and tendering/contracting methods.
2. Develop WBS and CPM scheduling skills for critical path determination.
3. Enable PERT-based duration estimation and resource allocation for balanced schedules.
4. Train in site organization, earned value analysis, and quality & safety principles.
5. Equip with project control systems to correct overruns and assess modern equipment/automation.
6. Familiarize with contract management fundamentals and planning software (Primavera/MS Project).

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

1. Explain the construction project life cycle, stakeholder roles, and tendering process.
2. Create WBS and CPM schedules to identify critical path and floats.
3. Perform PERT analysis and resource allocation for optimal schedules.
4. Plan site organization, apply earned value analysis, and use quality & safety principles.
5. Implement project control systems to detect overruns and assess modern equipment.
6. Explain contract management basics and demonstrate planning software usage.

Module	Contents	Hrs	COs
I	**Introduction to Projects & Planning:** Definition of a project, its life cycle and phases. Stages of project planning: pre-tender, pre-construction, and detailed construction. Roles of client and contractor. Tendering: types and stages. Types of contracts (item rate, lumpsum, BOT)	07	CO01
II	**Work Breakdown & Scheduling Techniques (CPM):** Work Breakdown Structure (WBS), activity lists, estimating durations, and activity sequencing. Introduction to planning techniques: Bar charts and Gantt charts. CPM networks: basic terminology, precedence relationships, activity-on-link (AOL) and activity-on-node (AON) diagrams. Float computation, critical and semi-critical path identification.	08	CO-02
III	**PERT Analysis & Resource Management:** Assumptions of PERT, determining three time estimates, calculating expected duration, slack, and probability of project completion. Resource allocation: managing materials, equipment, labor, and finance. Concepts of resource leveling and smoothing to create optimal schedules.	07	CO-03

IV	**Site Organization & Modern Systems:** Planning site layout, organization, and documentation. Introduction to Earned Value Analysis, S-Curves, and histograms for tracking progress. Quality control concepts, use of checklists, and basics of statistical quality control. Safety planning: accident causes, cost, and prevention. Modern management systems: Lean Construction and Building Information Modelling (BIM).	8	CO-04
V	**Project Control & Modern Methods:** Systems for project control, documentation, reporting, and meetings. Methods and frequency of updating plans. Common causes of time and cost overruns and corrective actions. Introduction to major construction equipment, automation, robotics, and construction methods for various structure types.	09	CO-05
VI	**Contracts Management (Overview) & Integrated Learning:** Introduction to contract management, common clauses (delays, penalties, variations), and dispute resolution. Tutorials on using planning software (like Primavera or MS Project).	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.

Term work: Students have to submit min one assignment or activity report in each module conducted in class. TW will be for 25 marks.

Recommended Books

1. Construction Project Management: Planning, Scheduling and Controlling by K.K. Chitkara
2. Construction Project Management: Theory and Practice by Kumar Neeraj Jha
3. Construction Planning and Management by P.S. Gahlot and B.M. Dhir
4. Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects, and Builders by Chris Hendrickson and Tung Au
5. Construction Planning, Programming and Control by Brian Cooke (4th Edition)
6. Construction Project Scheduling and Control by Saleh A. Mubarak (5th Edition)

Reference Books

1. Construction Engineering and Management by S.C. Sharma and S.V. Deodhar
2. PERT and CPM: Principles and Applications by L.S. Srinath
3. Construction Management by T. Williams (Pearson Education India)
4. Construction Planning and Technology by I.H. Khan
5. Construction Planning and Management by U.K. Srivastava
6. Building Lean, Building BIM by Rafael Sacks