Dr. Vasantraodada Patil Shetkari Shikshan Mandal's

PADMABHOOSHAN VASANTRAODADA PATIL INSTITUTE OF TECHNOLOGY, BUDHGAON, SANGLI- 416304.

An Autonomous Institute

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(Accredited by NAAC)

M.Tech. STRUCTURAL ENGINEERING

Curriculum for
M.Tech. STRUCTURAL ENGINEERING

In accordance with the *National Education Policy (NEP) 2020*, including curriculum structure and evaluation scheme

Effective from Academic Year 2025–2026

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M.Tech. STRUCTURAL ENGINEERING

Curriculum Structure and Evaluation Scheme

(2025-27 Batch)

SEMESTER I

Course Code	Course Name	Teaching Scheme				Evaluation Scheme					TOTAL
							Theory		Practical		
		L	T	P	Credit	Scheme	Max	Minimum Marks for Passing	Max	Minimum Marks for Passing	
0CEPCC501	Design of Bridges	3	-	-	3	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEPCC502	Earthquake Engineering and Structural Dynamics	3	-	-	3	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEPCC503	Advanced Structural Analysis	3	-	-	3	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CERMC504	Research Methodology, IPR and Research Ethics	3	1	-	4	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEPEC505	Program Elective Course– I	3	-	-	3	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEPCC506	Structural Dynamics Lab	-	-	2	1	ISE ESE	-	-	25 25	20	50
0CEPCC507	Modern Material Lab	-	-	2	1	ISE ESE	-	-	25 25	20	50
0CEAEC508	Software Applications in Civil Engineering Lab I	-	-	4	2	ISE	-	-	50	20	50
0CECCC509	YOGA for Stress Management	-	-	2	AU	ISE	-	-	-	-	AU
TOTAL		15	1	10	20	**TOTAL MARKS**					650
Total Contact Hours Per Week		26									

Course Category	PCC	PEC	RMC	VSE	CCC	Total
Credit	12	3	3	2	AU	20

List of Program Elective Course- I

Advanced Prestressed Concrete	Design of Pre-Engineered Buildings
Design of Tall Buildings	Theory of Elasticity and Plasticity

Abbreviations:

ISE 1:-In semester evaluation 1, ISE 2:- In semester evaluation 2, MSE: - Mid Semester Examination, ESE: - End Semester Examination. *Passing Criteria:- ISE + MSE + ESE ≥ 40 % Marks and ESE has separate passing ≥ 40 % Marks.

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M.Tech. STRUCTURAL ENGINEERING

Curriculum Structure and Evaluation Scheme

(2025-27 Batch)

SEMESTER II

Course Code	Course Name	Teaching Scheme				Evaluation Scheme					Total
							Theory		Practical		
		L	T	P	Credit	Scheme	Max	Minimum Marks for Passing	Max	Minimum Marks for Passing	
0CEPCC551	Finite Element Analysis	3	-	-	3	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEPCC552	Advanced Design of R.C. Structures	3	-	-	3	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEPEC553	Program Elective Course- II	3	-	-	3	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEPEC554	Program Elective Course– III	2	-	-	2	ISE 1 MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEOEC555	Open Elective Course- I	3	-	-	3	ISE I MSE ISE 2 ESE	10 20 10 60	40	-	-	100
0CEVSE556	Mini Project	-	-	4	2	ISE ESE	- -	-	25 25	20	50
0CEAEC557	Software Applications in Civil Engineering Lab II	-	-	4	2	ISE ESE	- -	-	25 25	20	50
0CEEEM558	Entrepreneurship/ Economics/ Management Course	2	-	-	2	ISE I MSE ISE 2 ESE	10 20 10 60	40	-	-	100
TOTAL		16	-	8	20	**TOTAL MARKS**					700
Total Contact Hours Per Week		24									

Course Category	PCC	PEC	OEC	AEC	VSE	EEM	Total
Credit	6	5	3	2	2	2	20

PEC II	PEC III	OEC I	EEM
Advanced Design of Steel Structures	Application of AIML in Structural Engg	Structural Optimization	Innovation, Entrepreneurship & Start-up Management
Design of Industrial Structure	Structural Health Monitoring and Audit	Industrial Safety	Project Management & Strategic Planning
Theory of Plates and Shells	Advanced Construction Materials	Project Management in Structural Engineering	Engineering Economics & Cost Analysis

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SEMESTER III

Course Code	Course Name	Teaching Scheme				Evaluation Scheme					TOTAL
							Theory		Practical		
		L	T	P	Credit	Scheme	Max	Minimum Marks for Passing	Max	Minimum Marks for Passing	
0CEPCC601	MOOC/SWAYAM/ NPTEL PLATFORM COURSES/Self Study. (It is desirable to choose one course from each of PE, OE &AE)	3	-	-	3	ISE 1	10	40	-	-	100
						MSE	20				
						ISE 2	10				
						ESE	60				
0CEPEC602		3	-	-	3	ISE 1	10	40	-	-	100
						MSE	20				
						ISE 2	10				
						ESE	60				
0CEOEC603		3	-	-	3	ISE 1	10	40	-	-	100
						MSE	20				
						ISE 2	10				
						ESE	60				
0CEINT604	Internship	-		4	2	ISE	-	-	50	20	50
0CEAEC605	Seminar	-	-	2	1	ISE	-	-	25	20	50
						ESE	-		25		
0CEDIS606	Dissertation Phase-I	-	-	16	8	ISE	-	-	50	40	100
						ESE	-		50		
Total		**9**	**0**	**22**	**20**	**TOTAL MARKS**					**500**
Total Contact Hours Per Week		**31**									

Course Category	PCC	PEC	OEC	DIS/INT	AEC	Total
Credit	3	3	3	10	1	20

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Curriculum Structure and Evaluation Scheme

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SEMESTER IV

Course Code	Course Name	Teaching Scheme				Evaluation Scheme					TOTAL
							Theory		Practical		
		L	T	P	Credit	Scheme	Max	Minimum Marks for Passing	Max	Minimum Marks for Passing	
0CEINT651	Internship	-		4	2	ISE			50	40	100
						ESE			50		
0CEDIS652	Dissertation Phase -II	-	-	36	18	ISE	-	-	100	80	200
						ESE	-		100		
	Total	-	-	40	20	**TOTAL MARKS**					300
Total Contact Hours Per Week		40									

***One Article Publication is mandatory**

Course Category	DIS/INT	Total
Credit	20	20

Summary of Semester wise Credits

Semester I	Semester II	Semester III	Semester IV	Total Credits
20	20	20	20	80

Summary of Programme Components and Credits

Component	Semester I	Semester II	Semester III	Semester IV	Total Credits
Programme Core Course (PCC)	11	06	03	-	20
Programme Elective Course (PEC)	03	05	03	-	11
Open Elective Course (OEC)	-	03	03	-	06
Vocational and Skill Enhancement Course (VSE)	-	02	-	-	02
Ability Enhancement Course (AEC)	02	02	01	-	05
Entrepreneurship/Economics/Management Course (EEM)	-	02	-	-	02
Research Methodology (RMC)	04	-	-	-	04
Dissertation/Project/Internship (DIS/INT)	-	-	10	20	30
Co-Curricular Course (CCC)	AU	-	-	-	AU
Total	20	20	20	20	80

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SEMESTER I

Design of Bridges

Course Code and Course Title	**0CVPCC501 Design of Bridges**			
Semester	I			
Pre-requisite's	UG -Bridge engineering, Design of concrete structures			
Teaching Scheme (Hours per week)	Lecture	Tutorial	Practical	
	03	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO's): - Upon successful completion of this course, the student will be able to:		**BL**
CO 1	Understand the fundamentals of bridge engineering	**2**
CO 2	Evaluate various loadings on bridges.	**3**
CO 3	Analyse various type of bridges with appropriate loads and methods.	**4**
CO4	Design various bridges and bearings with reinforcement detail.	**5**
Course Content		**Hrs**
Unit 1	**Introduction to Bridge Engineering:** Introduction, Importance of bridges, Selection of bridge type and site, Economic span, General arrangement of various types of bridges, Geometric design parameters.	**04**
Unit 2	**Loading on Bridges:** Loading standards for roads and railway bridges as per IRC standards and IRS standards, Analysis of other loads like Impact factor, Centrifugal forces, Wind load, Earthquake load, Hydraulic forces, Longitudinal forces, Earth pressure, Buoyancy effects.	**05**
Unit 3	**Analysis and design of culvert:** Design of RC culvert, Box culvert, Pipe culvert.	**06**
Unit 4	**RC and Prestressed deck slab:** Design of R. C. deck slab, Beam and slab, T beam, Pigweed's theory, Courbon's theory. **Prestressed concrete bridges**: General aspect, Advantages, Analysis and design of prestressed bridges decks.	**10**

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Unit 5	**Foundation design**: Design of bridge foundation, piers, abutments, wing walls.	**06**
Unit 6	**Bearing and Joint:** Bearing and expansion joints, forces on bearings, Types of bearings, design of unreinforced elastomeric bearings, expansion joints, Inspection maintenance and repair of bridges.	**05**
Total Hours		**36**

Text Books:	
1	Dr. V. K. Raina, Concrete Bridge Practice: Analysis, Design and Economics, Shroff Publishers & Distributors Pvt Ltd
2	Jagadish & Jayaram, Design of Concrete Bridges, Tata McGraw Hill.
3	Ponnuswamy S., Bridge Engineering, Tata McGraw Hill.
4	Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Reinforced Concrete Structures, Vol. II, Laxmi Publications
Reference Books:	
1	Victor, Design of Concrete Bridges, Tata McGraw Hill.
2	N. Krishnaraju, Prestressed Concrete Bridges, CBS Publishers & Distributors Pvt. Ltd.
3	Dr. V. K. Raina., Concrete Bridge Practice: Construction, Maintenance & Rehabilitation, Shroff Publishers & Distrib. Pvt Ltd.
4	Dr.V.K.Raina, Field Manual for Highway & Bridge Engineers, Shroff Publishers & Distributors Pvt Ltd
5.	David Lee, Bridge Bearing and Expansion Joints.

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Earthquake Engineering and Structural Dynamics

Course Code and Course Title		**OCEPCC502** Earthquake Engineering and Structural Dynamics			
Semester		I			
Pre-requisite's		UG Earthquake Engineering.			
Teaching Scheme (Hours per week)		Lecture	Tutorial	Practical	
		03	-	-	
Credit		03			
Evaluation Scheme		**ISE 1**	**MSE**	**ISE 2**	**ESE**
		10 Marks	20 Marks	10 Marks	60 Marks
Course Outcomes (CO's): - Upon successful completion of this course, the student will be able to:					**BL**
CO 1	Analyze SDOF and MDOF structural systems under dynamic and seismic loading.				**4**
CO 2	Evaluate earthquake ground motion characteristics and construct response spectra.				**5**
CO 3	Apply IS 1893:2016 and IS 13920:2016 provisions for seismic design of RC structures.				**3**
CO4	Design beams, columns, and structural elements with ductile detailing.				**6**
CO5	Implement vibration control techniques and isolation measures in structures.				**3**
Course Content					**Hrs.**
Unit 1	**Fundamentals of Structural Dynamics** Simple Structures, Characteristics of dynamic loading, SDOF systems, Free vibrations, Harmonic loading, Harmonic base motion, Resonance, Dynamic Amplification Factor, Transmissibility, Vibration Isolation, Force-Displacement Relation, Damping Force, Equation of Motion, Mass-Spring-Damper Systems, Free vibration (un-damped & viscously damped), Response to harmonic & periodic excitations.				**07**
Unit 2	**Multi-Degree-of-Freedom Systems** MDOF systems, Two-storey shear buildings, General approach for linear systems, Static condensation, Symmetric & asymmetric systems subjected to ground motion.				**06**
Unit 3	**Earthquake Ground Motion & Response Spectra** Strong motion measurement, Characteristics of earthquake ground motion, Response spectrum, Displacement, pseudo-velocity & pseudo-acceleration spectra, Tripartite spectra, Maximum Considered Earthquake (MCE) & Design Basis Earthquake (DBE), Construction of site-specific design spectra.				**06**

Unit 4	**Seismic Design Philosophy & Code Provisions** Earthquake-resistant design philosophy, Provisions of IS 1893:2016 (Part I), Estimation of earthquake forces, Seismic coefficient method, Response spectrum analysis, Asymmetrical structures, Accidental eccentricity.	**06**
Unit 5	**Earthquake Resistant Design** Earthquake-resistant design principles, Ductility, Inelastic behaviour, Ductile detailing of RC members (IS 13920:2016), Design of beams & columns.	**06**
Unit 6	**Advanced Techniques in Seismic Design** Vibration control techniques, Base isolation, Energy dissipation devices, and Performance-based seismic design.	**06**
	Total Hours	**36**

Text Books:	
1	R.W. Clough & Joseph Penziene, Dynamics of Structures, Mc-Grew Hill Publications.
2	A.K. Chopra, Dynamics of Structures: Theory &Application to Earthquake Engineering, Prentice Hall Publications.
3	Mario Paz, Structural Dynamics, CBS Publication.
4	Roy Craig, Structural Dynamics, John-Wiley& Sons.
5	JagmohanL, Humar, Dynamics of Structures, Swetsand, Zeitlinger, Netharlands.
Reference Books:	
1	Jaikrisna, A.R. Chandrashekharan, Elements of earthquake Engineering, South Asian Publishers.
2	Mukhopadhayay Madhujit, Structural Dynamics Vibration and systems, And Books India Publisher.
3	PatrickPaultre, Dynamics of Structures, Wiley India
4	IS 1893:2016 (Part I), Criteria for Earthquake Resistant Design of Structures
5	IS 13920:2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces

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Advanced Structural Analysis

Course Code and Course Title	**0CEPCC503 Advanced Structural Analysis**			
Semester	I			
Prerequisites	Mechanics of Solids, Structural Mechanics			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	Analyse the structure by applying the stiffness matrix and flexibility matrix	**4**
CO2	Develop ILD for reactions, shear forces, and bending moments for indeterminate structures.	**4**
CO3	Analyze infinite, semi-infinite, and finite beams subjected to various loading	**4**
CO4	Construct SFD, BMD, and TMD for curved beams under various loading and support conditions.	**4**
CO5	Apply the concept of plastic analysis to determine collapse loads, plastic moments, and load-carrying capacity of beams.	**3**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Flexibility Matrix Method:** Introduction, flexibility matrix, analysis of continuous beams, plane frame and trusses by flexibility matrix method.	**6**
Unit 2	**Stiffness Matrix Method:** Introduction, stiffness matrix, relation between stiffness and flexibility matrices, analysis of continuous beams, plane frame and trusses by stiffness matrix method.	**6**
Unit 3	**Influence Line Diagrams for Indeterminate Structures:** Concept of ILD, Muller-Breslau's Principle and its application to Continuous beams. ILD for two hinged arches.	**6**
Unit 4	**Beams on Elastic Foundations**: Basic concept of beams on elastic Foundations, Analysis of infinite, semi-infinite & finite beams.	**6**
Unit 5	**Beams Curved in Plan:** Introduction, structural behavior of curved beam, analysis of determinate & indeterminate beams curved in plan.	**6**
Unit 6	**Plastic Analysis:** Introduction to plastic analysis concepts, Assumptions in plastic analysis, Shape factor for different cross sections, Collapse load and load factor, Plastic modulus and moment of resistance, Calculation of collapse load for fixed beams, continuous beams.	**6**
	Total Hours	**36**

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Text Books:
1. Vazirani and Ratwani, "Advanced Theory of Structures & Matrix method", Khanna Publisher, Delhi.
2. Reddy C.S., "Basic structural Analysis", Tata McGraw Hill, Delhi.
3. Matrix methods of structural Analysis- S. S. Bhavikatti, Vikas Publishing House Pvt Ltd
4. Advanced Structural Analysis – Ashok K. Jain, New Channel Brothers
Reference Book:
1. Timoshenko and Gere, "Strength of Materials", East West Press Ltd.
2. Gere and Weaver, "Matrix Analysis of Framed Structures", CBS Publishing, Delhi.
3. Pandit & Gupta, "Structural Analysis - A matrix approach", Tata McGraw Hill, Delhi.
4. Negi and Jangid, "Structural Analysis", Tata McGraw Hill Pub. Co. Delhi
5. N. Krishnaraju and D.R. Gururaja, "Advanced Mechanics of Solids & Structures", Narosa Pub. House

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Research Methodology, IPR and Professional Ethics

Course Code and Course Title	**Research Methodology, IPR and Professional Ethics**			
Semester	I			
Prerequisites	B.Tech in Civil Engineering and allied Branches			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	1	-	
Credit	04			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO 1	**Understand** the scope and purpose of research in engineering	**2**
CO 2	**Apply** research methods to identify research problems and conduct	**3**
CO 3	**Examine** methodology and interpret data accurately.	**4**
CO 4	**Apply** IPR principles to protect engineering innovations.	**3**
CO 5	**Demonstrate** awareness of ethical research and integrity.	**3**
CO 6	**Prepare** professional research reports and proposals.	**6**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to Research and Its Significance** Meaning, objectives, and importance of research, Research types: Fundamental, Applied, Analytical, Experimental, and Interdisciplinary, Research process, characteristics, and scope in civil/structural engineering, Recent trends in structural engineering research (sustainability, materials, resilience).	**6**
Unit 2	**Research Problem Identification and Literature Review** Identifying and formulating research problems, Defining objectives, hypothesis, and scope, Sources of problems: field issues, industrial challenges, academic gaps, Literature survey: process, tools, and databases (Scopus, Web of Science, ASCE), Use of reference managers (Mendeley, Zotero, EndNote).	**6**
Unit 3	**Research Design, Data Collection and Analysis** Research design: concepts, types, and applications, Data collection: primary and secondary sources, Sampling methods, reliability, and validity, Statistical analysis: descriptive statistics, correlation, regression, hypothesis testing, Use of analysis tools (Excel, SPSS, MATLAB).	

Unit 4	**Intellectual Property Rights (IPR) and Patents** Introduction to IPR and its significance, Types: Patents, Copyrights, Trademarks, Industrial Designs, Trade Secrets, Patent structure and filing procedure (India & International), Case studies: Patents in concrete technology and smart structures, Technology transfer, commercialization, and innovation management.	**6**
Unit 5	**Research Ethics, Plagiarism and Publication Practices** Ethics in research: honesty, transparency, accountability, Fabrication, falsification, plagiarism: definitions and consequences, Plagiarism detection software (Turnitin, Urkund), Publication ethics: predatory journals, peer review, impact factor, authorship criteria, Case studies on ethical misconduct.	**6**
Unit 6	**Research Documentation, Proposal and Report Writing** Research proposal components: title, objectives, methodology, timeline, budget; Technical paper writing: structure, formatting, referencing (APA, IEEE); Dissertation / Thesis writing structure and presentation; Seminar, defence, and publication preparation.	**6**
Total Hours		**36**

List of Tutorials

Tutorial No.	Title	Hrs.
1	Discussion on real-life structural engineering problems; review of recent journal articles (ASCE / Elsevier).	1
2	Group mapping of research stages from topic identification to report writing; flowchart preparation.	1
3	Identify a topic, write problem statement, objectives, and hypothesis. Peer review for clarity.	1
4	Practical session on use of Google Scholar, Scopus; citation management using Mendeley/Zotero.	1
5	Choose one problem and define research design, variables, and	1
6	Hands-on analysis using Excel/SPSS — correlation, regression,	1
7	Select one published experimental study (e.g., concrete mix, beam test) and interpret data trends.	1
8	Discuss types of IPR and identify examples related to civil engineering	1
9	Each student prepares a one-page abstract for a hypothetical patent on an innovative structural material/product.	1
10	Analyze a given report with plagiarized text; check similarity using Turnitin/Urkund (demonstration).	1

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11	Examine journal websites (Elsevier, Springer) and distinguish predatory vs. authentic publishers.	**1**
12	Prepare and present a mini research proposal including objectives, methodology, and expected outcomes.	**1**

Text Books:

Reference Book:

1.Research Methodology: Methods and Techniques, New Age International, C.R. Kothari & Gaurav Garg

2.Research Methodology: A Step-by-Step Guide for Beginners, Sage, Ranjit Kumar

3.Indian Patents Law and Practice, Taxman Publications, D.P. Mittal

4.Law Relating to Patents, Trade Marks, Copyright, and Designs, B.L. Wadehra

5.On Being a Scientist: Responsible Conduct in Research, National Academy of Sciences

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Advanced Prestressed Concrete

Course Code and Course Title	**0CEPEC505 Advanced Prestressed concrete**			
Semester	I			
Prerequisites	Design of Concrete Structures and Structural Analysis.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:		**BL**
CO1	**Analyze** the PSC member for flexural, shear strength and deflection.	**4**
CO2	**Analyze** and design of the anchor blocks.	**5**
CO3	**Design** the simple and indeterminate structures like continuous beams and portal frames.	**6**
CO4	**Analyze and design** composite section and various slabs.	**5**
CO5	**Design** various special types of PSC structures like pipes, poles, tanks, sleepers.	**6**
CO6	**Understand** the causes of various defects in PSC structure and remedies for it.	**2**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to Pre-stressed Concrete:** Basic Principle of Pre-stressing, Methods and Systems of Pre-stressing, Material Requirements, Losses of Pre-stressing, Analysis of Rectangular, Symmetrical and Unsymmetrical, Flanged Beams, Concept of Cable Profile, Pressure Line, Thrust Lines, etc.	**6**
Unit 2	**Analysis and Design of PSC Members**: Analysis of PSC section for Flexural Strength, Shear Strength and Deflection, Design of Pre-stressed Concrete section for Flexural Strength by Analytical procedure and Magnet's Graphical method, Shear Strength and Deflection, Design of Statically Indeterminate Beams, Concordant Cable Profile.	**8**

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Unit 3	**Design of Anchor Blocks**: Transfer of pre-stress in pretension members: Pretension transfer bond, Transmission length, endzone reinforcement **Post tensioned members:** Design of Anchor Blocks using Mangle's Method, Guyon's Method and IS Code Method.	**6**
Unit 4	**Composite Section**: Analysis and Design of Composite Construction of Pre-stressed and in-situ Concrete Structures, Design of One way and Two-way Slab, Grid Slab.	**6**
Unit 5	**Design of Various PSC Structures:** Circular Pre-stressing for Water Tanks, Design of Cylindrical and Non-cylindrical Pipes, Design of Sleepers, Design of Poles.	**4**
Unit 6	**Causes and Remedies of Various Defects in PSC**: Causes of various Defects in Pre-stressed Concrete like Cracking, Buckling, Deflection, Deterioration, Corrosion of Pre-stressing Steel, Concrete Crushing at End Anchorages, Grouting of Post Tensioned Tendons, Congested Connections, Dimensional Tolerances etc. and Remedial Measures	**6**
	Total Hours	**36**

Text Books:

1. N. Krishnaraju, Pre-stressed Concrete, Tata McGraw-Hill Publishing Company.
2. Sinha and Roy, Fundamentals of Pre-stressed Concrete, S. Chand Ltd.
3. S. Ramamruthm, Pre-tsressed Concrete, Dhanpat Rai and Sons.
4. N. Rajagopalan, Pre-stressed Concrete, Narosa Publishing House.

Reference Book:

1. T. Y. Lin &Nedbhurns, Design of Pre-stressed Concrete Structures, John Wiley & Sons
2. James R. Libby, Modern Pre-stressed Concrete, CBS Publishers & Distributors Pvt. Ltd.
3. IS 1343: 2012, Indian Standard Code of Practice for Pre-stressed Concrete.
4. IS 784: 2001, Indian Standard Code for Circular Pre-stressing in pre-stressed concrete pipes.

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Design of Tall Building

Course Code and Course Title	**0CEPEC505 Design of Tall Building**			
Semester	I			
Prerequisites	Analysis and Design of Reinforced concrete structures			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	The students will understand fundamental concept, design philosophy of high-rise structure.	**2**
CO2	Construct SFD and BMD in building frame by approximate analysis method.	**4**
CO3	Design RC shear wall and chimney.	**6**
CO4	Analyze, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.	**4**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to Tall Buildings:** Tall buildings – Design process, Philosophy, Scope and design criteria – design philosophy, Strength and stability, Stiffness, Creep and temperature effects, Fire loading, gravity, Wind, earthquake and combine loading.	**6**
Unit 2	**Analysis of Multistorey Building Frames: I:** Analysis of Multistorey Building Frames for lateral loads by Cantilever method and Portal method.	**6**
Unit 3	**Analysis of Multistorey Building Frames: II:** Analysis of Multistorey Building Frames for lateral loads by Factor method and Substitute Frame Method.	**6**
Unit 4	**Design of RCC Chimney:** Introduction, Wind pressure, Stress in chimney shaft due to self-weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference, Design of RC chimney.	**6**
Unit 5	**Design of Shear Wall:** Introduction, Types of shear walls, Behaviour of cantilever wall with rectangular cross-section, flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid joined frames, Shear walls with openings, Coupled shear walls.	**6**
Unit 6	**Cooling & Transmission Towers:** Types, Components, Analysis and Design. Types of Loads, Tower Configuration, Analysis and Design.	**6**
	Total Hours	**36**

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Text Books:
1. Krishnaraju N., "Advanced Reinforced Concrete Design", CBS Publisher.
2. Punmia B. C. & Jain A. K., "Reinforced Concrete Structures", Laxmi Publications.
3. Manohar S. N., "Tall Chimneys", Mcgraw-Hill Publications.
4. A. R. Shanthakumar and S. S. Murthy, Transmission Line Structures, Tata Mcgraw-Hill, 1990
Reference Book:
1. Park R. & Paulay T., Reinforced Concrete Structures, John Wiley & Sons.
2. Shah H. J., "Reinforced Concrete design", Charotar Publishing House.
3. Varghese P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India.
4. Purushothaman P., "Reinforced Concrete Structural Elements", Tata McGraw-Hill Publishing.

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Design of Pre – Engineered Buildings

Course Code and Course Title	**0CEPEC505 Design of Pre- Engineering buildings**			
Semester	I			
Prerequisites	Structural Analysis.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:		**BL**
CO1	Understand the various components of pre-engineered structures	**2**
CO2	To Analyze the different types of stresses acting on the structures while lifting the prefabricated structures and type of equipment required to support such stresses	**3**
CO3	Apply the latest Pre-Engineered Buildings equipment technique in the construction industry	**5**
CO4	Application of Pre-engineered structure in various sectors of building industry	**4**
CO5	Design of Pre-engineered structure	**5**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction: -** Pre- engineered building's introduction, history, advantage of PEB, application of PB, materials used for manufacturing of PB, difference between conventional Steel buildings and pre-engineered buildings.	**6**
Unit 2	**Pre- Engineering buildings components: -** Primary system main frames cable and frame, secondary frame system, size and properties of Berlin and gears, bracing system and cladding, Roof sheeting and wall seating accessories, Turbo ventilators, ridge vents, skylights, louvers insulation, staircases.	**7**

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Unit 3	**Design loads on pre- engineered buildings: -** Design PB frame under the influence of dead load, Live load Collateral wind seismic and other applicable loads, service ability limits as per code.	**8**
Unit 4	**PEB design methodology: -** Design parameters of PEB frames- Depth of the section, depth to flange width ratios, thickness of the flange to the thickness of web ratio, d/tw, h/tw ratios of sections as per Indian Standard code, section sizes as per manufacturing limitations, analysis and design of rigid friends.	**7**
Unit 5	**PEB frame connection design methodology: -** Rigid frame moment connection, Shear connection, high strength bolts and grades, Lever arm, Bolt pattern, its effect on connection design, thickness of connection plate, and selection of governing forces for connection design.	**8**
	Total Hours	**36**

Reference Book:
1. Design of steel structures" by S.K. Duggal Dr. B.C. Punmia.
2. "Design of steel structures" Dr. B.C. Punmia.
3. Indian Standards codes IS 800
4. Indian Standards codes IS 875
5. Technical Specification For Pre Engineered Building-Bhel Ltd.

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Theory of Elasticity and Plasticity

Course Code and Course Title	**0CEPEC505 Theory Of Elasticity and Plasticity**			
Semester	I			
Prerequisites	Basic knowledge of Solid Mechanics, Structural Analysis, Engineering Mathematics, and Material Behavior.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3		-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	Analyze stress and strain at a point in 3D, derive equilibrium and compatibility equations.	**4**
CO2	Apply generalized Hooke's law and Airy's stress function to solve plane stress/strain problems.	**3**
CO3	Solve classical problems in elasticity including stress concentration and axisymmetric problems.	**3**
CO4	Analyze members under torsion using St. Venant's theory, membrane analogy, and energy principles.	**4**
CO5	Evaluate plastic behavior, yield criteria, and plastic deformation in structural members.	**5**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Module 1: Analysis of Stress and Strain** Concept of stress at a point, stress tensor, principal stresses, Mohr's circle, strain displacement, strain compatibility, Navier-Lame's equations, Beltrami-Michell equations, boundary value problems.	**7**
Unit 2	**Module 2: Stress-Strain Relationship** Generalized Hooke's law for isotropic and orthotropic materials, Plane stress/strain, Airy's stress function, bending of beams, and shear centre in open sections.	**7**

Unit 3	**Module 3: Stress Concentration Problems** Kausch's problem, Michell's and Flamant's problems, Lame's thick cylinder problem, stress concentration due to holes and concentrated loads.	**6**
Unit 4	Module 4: Torsion St. Venant's theory, torsion of circular and non-circular sections, Prandtl's membrane analogy, warping, shear flow in thin-walled sections.	**6**
Unit 5	**Module 5: Plasticity** Idealized plastic behavior, Coulomb friction, yield criteria (Rankine, Tresca, von Mises, Saint Venant), stress-strain relations, perfectly plastic flow, beam bending, torsion of shafts.	**6**
Unit 6	**Module 6: Plastic Analysis of Structures** Plastic hinge, shape factor, upper/lower bound theorems, plastic collapse load of beams and frames.	**4**
	Total Hours	**36**

Text Books:

1. Timoshenko, S. P. & Goodier, J. N. Theory of Elasticity, 3rd Edition, McGraw-Hill, 1970.
2. Sadhu Singh. Theory of Plasticity & Metal Forming Processes, 3rd Edition, Khanna Publishers, 1999.
3. Martin H. Sadd. Elasticity: Theory, Applications & Numerics, (Latest / 5th Edition), Academic Press / Elsevier.
4. L. S. Srinath. Advanced Solid Mechanics, Tata McGraw-Hill.

Reference Books:

1. Shames, Irving H. Mechanics of Deformable Solids, Prentice Hall, 1964.
2. Chakrabarty, J. Theory of Plasticity, 3rd Edition, McGraw-Hill / Butterworth-Heinemann, 2006.
3. Johnson, W. & Mellor, J. Engineering Plasticity, Van Nostrand (edition / year not confirmed).
4. Kazimi, M. A. Solid Mechanics, Tata McGraw-Hill (edition / year not confirmed).
5. Wang, Applied Elasticity, Dover Publications (edition / year not confirmed).

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Structural Dynamics Lab

Course Code and Course Title	**0CEPCC506 Structural Dynamics Laboratory**		
Semester	I		
Prerequisites	UG Earthquake Engineering		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	02
Credits	01		
Evaluation Scheme	ISE: - 50 Marks		

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	Demonstrate understanding of fundamental vibration concepts through experiments on S.D.O.F and M.D.O.F systems.	**3**
CO2	Conduct experiments to determine natural frequency, damping ratio, and mode shapes of structural systems.	**4**
CO3	Analyze and interpret the impulse response, response spectrum, and torsional behavior of structural models.	**5**
CO4	Apply suitable vibration control techniques and evaluate their effectiveness for structural safety.	**6**

Experiment List (Any 7 performance are compulsory)

Expt. No.	**Title**	**Duration in Hrs**
1	Simple Harmonic Oscillator	2
2	Free Vibration of S.D.O.F System	2
3	Forced Vibration of S.D.O.F System	2
4	Impulse Response of S.D.O.F system	2
5	Concept of Response Spectrum	2
6	Vibration of M.D.O.F system	2
7	Behaviour of Rigid Blocks	2
8	Torsional Response of Building	2
9	Continuous Systems	2
10	Vibration Control	2

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References books :
Chopra, A.K. — Dynamics of Structures: Theory and Applications to Earthquake Engineering, Pearson Education.
Clough, R.W. and Penzien, J. — Dynamics of Structures, McGraw-Hill.
Rao, S.S. — Mechanical Vibrations, Pearson Education.
Biggs, J.M. — Introduction to Structural Dynamics, McGraw-Hill.
Humar, J.L. — Dynamics of Structures, CRC Press.
Virtual Lab Resources (NPTEL & MOE Virtual Labs)
1. **Structural Dynamics Virtual Lab** – IIT Roorkee https://sdvlab.iitr.ac.in
2. **Vibration and Acoustics Lab** – IIT Kharagpur https://va-iitkgp.vlabs.ac.in
3. **Earthquake Engineering Virtual Lab** – IIT Kanpur https://eev.iitk.ac.in
4. **Mechanical Vibrations Virtual Lab** – IIT Guwahati https://mv-iitg.vlabs.ac.in
NPTEL Courses:
Structural Dynamics by Prof. S. Chakraborty (IIT Kharagpur)
Advanced Structural Analysis by Prof. Devdas Menon (IIT Madras)

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Modern Material Lab

Course Code and Course Title	**0CEPCC507 Modern Material Laboratory**		
Semester	I		
Prerequisites	U.G. Concrete Technology Lab		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	02
Credits	01		
Evaluation Scheme	ISE: - 50 Marks		

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	Design and prepare high-performance, self-compacting, and fiber-reinforced concretes.	**3**
CO2	Experimentally evaluate mechanical and durability properties of modern concretes.	**4**
CO3	Conduct and interpret results from NDT and microstructural tests on advanced materials.	**5**
CO4	Assess sustainable and green concrete using industrial by-products and waste materials.	**4**
CO5	Develop experimental reports and recommendations for innovative construction materials.	**6**

Experiment List (Any 7 performance are compulsory)

Expt. No.	**Title**	**Duration in Hrs**
1	Mix design and preparation of High-Performance Concrete (HPC) as per IS 10262.	**2**
2	Workability tests (slump, flow table, compaction factor) and compressive strength testing of HPC.	**2**
3	Design and testing of Self-Compacting Concrete (SCC) – Slump flow, L-box, U-box tests.	**2**
4	Preparation and testing of Fiber Reinforced Concrete (FRC) for flexural and tensile behavior.	**2**
5	Study of Polymer Modified or Nano-Modified Concrete – preparation and durability testing.	**2**
6	Geopolymer Concrete preparation using fly ash or GGBS – evaluation of strength and setting time.	**2**
7	Non-Destructive Testing (NDT) – Rebound Hammer, Ultrasonic Pulse Velocity (UPV).	**2**

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8	Durability Tests – water absorption, acid attack, or chloride permeability.	**2**
9	Microstructural Characterization (demonstration/visit) – SEM, XRD, or FTIR analysis.	**2**

References:

1. Li, V.C., Engineered Cementitious Composites (ECC): Material, Structural, and Durability Performance, Springer.
2. Chung, D.D.L., Composite Materials: Science and Applications, Springer.
3. Siddique, R. & Naik, T.R., Sustainable Construction Materials and Technologies, Woodhead Publishing.
4. Neville, A.M., Concrete Technology, Addison Wesley.
5. IS Codes: IS 516, IS 5816, IS 10262, IS 1199, IS 13311 (Part 1 & 2).

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Software Application in Civil Engineering Lab-I

Course Code and Course Title	**0CEAEC508 Software Application in Civil Engineering Lab-I**		
Semester	I		
Prerequisites	Basic knowledge of structural analysis and design		
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**
	-	-	4
Credit	02		
Evaluation Scheme	**ISE 1**	**ISE 2**	
	25 Marks	25 Marks	

Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:		**BL**
CO1	Analyze RCC structural systems (building, retaining wall, flat slab, foundations, etc.) using structural design software as per IS 456:2000 and relevant codes.	**3**
CO2	Design RCC structural elements and foundations using software and validate results with manual checks.	**4**
CO3	Prepare reinforcement detailing drawings, interpret results, and compile a professional design report.	**6**

Course Content

Unit No.	**Contents**	**Hrs.**
1	**Activity 1: Analysis of RCC Structures using Software** • Introduction to RCC analysis software (STAAD.Pro / ETABS / SAP2000/SAFE). • Modeling and analysis of one of the following structures: – Multi-storey RCC building frame – RCC retaining wall – Flat slab system – RCC isolated / combined / raft foundation • Application of loads (DL, LL, WL, Earth pressure) as per IS 875 and IS 1893. • Extraction and interpretation of analysis results (bending moments, shear forces, reactions, deflections). • Validation of software results through theoretical comparison. Deliverables: Model file, load application sheet, and analysis report (member forces & deflection summary)	14

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2	**Activity 2: Design and Detailing of RCC Structures** Design of RCC members as per IS 456:2000 and IS 3370 / IS 875 (as applicable): – Beams, slabs, columns, and footings – Retaining wall or flat slab panels – Reinforcement detailing for structural elements • Preparation of reinforcement detailing drawings using AutoCAD / CAD RC. • Compilation of design report and presentation of results. Deliverables: Design calculations, reinforcement detailing drawings, final report, and presentation.	14
3	**Viva-Voce / Presentation / Report Submission** • Oral examination and evaluation of analytical and design work. • Assessment of report preparation, teamwork, and presentation skills.	8
	Note: Students shall select any one of the mentioned RCC structures (Building / Retaining Wall / Flat Slab / Foundation) and perform both mandatory activities 1. Analysis and Design & Detailing for the same selected structure	
	Total Hours	**36**

Text Books:

1. S. Unnikrishna Pillai & Devdas Menon, Reinforced Concrete Design, McGraw-Hill.
2. N. Krishna Raju, Design of Reinforced Concrete Structures, CBS Publishers.
3. P. C. Varghese, Advanced Reinforced Concrete Design, PHI Learning.
4. IS 456:2000, Plain and Reinforced Concrete – Code of Practice.
5. IS 875 (Part I–V) and IS 1893:2016, Load and Earthquake Codes.

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YOGA for Stress Management

Course Code and Course Title		0CECCC509 YOGA for Stress Management		
Semester		I		
Prerequisites		Basic knowledge of structural analysis and design		
Teaching Scheme (hours per week)		Lecture	Tutorial	Practical
		-	-	2
Credit		AU		
Evaluation Scheme		ISE 1	ISE 2	
		-	-	
Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:				**BL**
CO1	Understand the physiological and psychological aspects of stress and its impact on overall wellbeing.			
CO2	Learn and practice specific yoga postures, breathing exercises, and relaxation techniques to alleviate stress.			
CO3	Explore the connection between mindfulness, meditation, and stress reduction, fostering mental clarity.			
CO4	Discover holistic practices that promote better sleep, nutrition, and overall lifestyle habits for stress management.			
CO5	Develop practical skills to manage stress in daily life, enhancing resilience and promoting emotional balance			
Course Content				
Unit No.	**Contents**			**Hrs.**
Unit 1	**Introduction to Yoga for Stress Management** • Stress according to Western perspective • Stress according to Eastern perspective • Developmental process: Western and Eastern perspectives • Stress hazards and role of Yoga			**6**
Unit 2	**Meeting the Challenges of Stress** • Introduction to stress physiology • Stress, appetite, and dietary management – Modern & Yogic perspectives • Sleep and stress: understanding the relationship for effective management			**6**

Unit 3	**Stress Assessment Methods** • Tools for stress assessment as a valuable aid in management • Role of Yoga in prevention and management of stress-related disorders – research evidence • Concept of stress and its management – perspectives from Patanjali Yoga Sutra (Part 1/2/3)	**6**
Unit 4	**Stress Management** Concept of stress and its management – perspectives from Bhagavad Gita (Part 1/2/3)	**6**
Unit 5	**Yoga Practices for Stress Management** • Bio-Psycho-Socio-Spiritual model of stress management • Practical Yoga techniques for stress management • Breathing practices • Asana practices including: o Tadasana, Ardhakati Chakrasana, Ardha Chakrasana, Trikonasana, Vrikshasana, Vakarasana, Janu Sirshasana, Ushtrasana, Sashankasana, Ardhamatseyndrasana, Paschimottanasana, Poorvottanasana, Gomukhasana, Makarasana, Bhujangasana, Salambha Shalabhasana, Dhanurasana, Setubandhasana, Sarvangasana, Matsyasana • Relaxation practice: Deep Relaxation Technique (DRT)	**8**
	Total Hours	**32**

Text Books:

1. H. R. Nagendra and R. Nagarathna, Yoga for Promotion of Positive Health, Swami Vivekananda Yoga Prakashana, 2011.
2. R. Contrada & A. Baum (Eds.), The Handbook of Stress Science: Biology, Psychology, and Health, Springer Publishing Company, 2010.
3. M. Al'Absi (Ed.), Stress and Addiction: Biological and Psychological Mechanisms, Elsevier, 2011.
4. O. Van den Bergh, Principles and Practice of Stress Management, Guilford Publications, 2021.
5. Swami Muktibodhananda, Hatha Yoga Pradipika, Bihar School of Yoga, 1998

Reference Book:

1. Swami Satyananda Saraswati, Four Chapters on Freedom, Bihar School of Yoga, 1975.
2. Swami Tapasyananda, Srimad Bhagavad Gita, Sri Ramakrishna Math, 2012.

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SEMESTER II

Finite Element Analysis

Course Code and Course Title	**0CEPCC551 Finite Element Analysis**			
Semester	II			
Prerequisites	Structural Mechanics			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3		-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	**Understand** the different methods in structural analysis and basic concepts of finite element method.	**2**
CO2	**Analyze** 1-D problems related to structural analysis like Bars, spring, Beams and solve by generating stiffness matrix.	**4**
CO3	**Examine** the effect of element type selection (**CST**, **LST**, or **QST**) on the overall performance and computational efficiency of structural models.	**3**
CO4	**Develop** element stiffness matrix for thin plate and shell element.	**4**
CO5	**Interpret** stress distribution in axisymmetric structures with symmetric and asymmetric loading using 3D elements.	**4**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to FEM & Approximate Methods:** Introduction, Discretization, Types of Elements, Overview of Various Methods to Solve Integral & Differential Equations (Point Collocation Method, Method of Least Square, Weighted Residual Method, Galerkin's Method), Minimum Potential Energy Principle, Local & Global Finite Element Methods (Rayleigh-Ritz Method), Stepwise Procedure in FEM	**6**
Unit 2	**1D Element:** Application of FEM to Solve various 1-D problems (Shape Functions for 1-D Elements, Properties of Shape Functions, Lagrange Interpolating Polynomials), C0 Continuity, 1-D FE Analysis (Selection of Shape Function, Direct Approach for Assembly, Boundary Conditions (Geometric, Natural), Concept of Sub- Structuring (Static Condensation), Stiffness Matrix for Basic Bar & Beam Element, Solution of Differential Equation using FEM.	**6**

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Unit 3	**Development of stiffness matrix for 1D element:** C0 &C1 Continuity, Formulation of 1-D Beam Element, Classical Beam Theory, Element Equation Formulation, Application to Fixed and Continuous Beams.	**6**
Unit 4	**2D Element:** Types of 2D elements, Conditions of Symmetry & Anti Symmetry (Applications), CST, LST, QST Element (3- Node Triangular Element), 4-noded Rectangular Element, Pascal's Triangle and Pyramid, Stepwise Formulation.	**6**
Unit 5	**Plate and Shell Elements:** Formation of stiffness matrix for plate bending elements of triangular and quadrilateral shapes, cylindrical thin shell elements.	**6**
Unit 6	**3D Element:** 3-D Stress Analysis using FEM, Iso-parametric Formulation, 3-D Brick Element, Application to 3-D Analysis, FEA of Axi- symmetric Solids Subjected to Axi-symmetric geometry and Asymmetric Loads (Application of Partial FEM).	**6**
Total Hours		**36**

Text Books:

1 O.C.Zienkiewicz & R.L.Taylor, The Finite Element Method Vol .I & II, Tata McGraw Hill
2 J.N.Reddy, An introduction to the Finite Element Method , Tata McGraw Hill Pub.
3 R. D. Cook, Concept and Application of Finite Element Analysis, John Wiley & sons
4 Hutton D.V., Fundamentals of Finite Element Analysis, Tata McGraw Hill Pub.
5 Bathe K.J., Finite Element Procedures, PHI learning pvt.ltd

Reference Book:

1. M. Mukhopdhyay, Concept and Application of Finite Element Analysis, Oxford and IBH Publishing Co. Pvt. Ltd.
2. C. S. Desai & J. F. Abel, Introduction to the Finite Element Method, CBS Pub.
3. C. S .Krishnamoorthy, Programming in the Finite Element Method, Tata McGraw Hill
4. T.R.Chandrupatla and Belegundu, Introduction to the Finite Element in Engineering Prentice Hall of India, pvt.ltd
5. 5. Y. M. Desai, T.I Eldho, Finite Element Method with application in Engineering, Pearson , Delhi

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Text Books:
1. Reinforced concrete, Limit state design by Ashok K. Jain, New Chand & bros. Roorkee
2. Advanced Reinforced Concrete design by P.C. Vargese – Prentice Hall of India, Delhi
3. Advanced Reinforced Concrete design by N. Krishnaraju – CBS Publishers & Distributors, Delhi.
4. Design of Reinforced Concrete Structures - S. Ramamrutham, Dhanpat rai Publication
Reference Book:
1. IS 456-2000 - Plain and Reinforced Concrete - Code of Practice
2. IS 3370- 2009- Part 1 - 4 Code of Practice for concrete structures for the storage of liquids
3. Pillai.S.V.and Menon.D. Reinforced concrete design, Tata McGraw Hill Book Co.
4. Purushothaman, P. Reinforced concrete Structural Element Tata McGraw Hill Co.

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Advanced Design of R.C. Structures

Course Code and Course Title	**0CEPCC552 Advanced Design of R.C. Structures**			
Semester	I			
Prerequisites	Theory of Structures, Design of Reinforced concrete structures			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	Design flat slab and grid slab.	**6**
CO2	Design R.C.C. Deep beams.	**6**
CO3	Design R.C.C. elevated service reservoir and retaining wall.	**6**
CO4	Analyse and design combined footing, raft foundation & pile foundation.	**6**
CO5	Design bunkers and silos using Airy's theory to ensure structural stability and safe load-bearing performance.	**6**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Flat Slab and Grid Slab** Classification, Behaviour of Flat slabs, Direct design and equivalent frame method, IS codal provisions, Analysis and design of grid Slab.	**6**
Unit 2	**Deep Beams** Introduction, Minimum thickness, Analysis and Design of deep beams as per IS 456-2000, Checking for local failures, Detailing of deep beams.	**6**
Unit 3	**Water Tanks** Introduction to working stress method for water tank design, Design criteria, permissible stresses, Analysis and design of overhead water tank – Rectangular & circular.	**6**
Unit 4	**Design of Foundation** Analysis and design of combined footing, raft foundation & pile foundation.	**6**
Unit 5	**Retaining wall** Function, Theories of earth pressure, Stability of retaining wall. Analysis and Design of cantilever retaining walls and counter-fort retaining walls.	**6**
Unit 6	**Bunker and silos** Classification, Design of Square and circular bunkers. Silos, Airy's theory, Design of shallow bins and deep bins.	**6**
	Total Hours	**36**

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Advanced Design of Steel Structures

Course Code and Course Title	**0EPEC553 Advanced Design of Steel Structures**			
Semester	II			
Prerequisites	UG -Design of steel structures			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	Analyse and Design of Portal Frames.	**6**
CO2	Design Pre –Engineered Buildings.	**6**
CO3	Design of Truss Girder Bridge.	**6**
CO4	Design of steel beams with Web openings.	**6**
CO5	Analyse and Design Cold Formed light gauge steel sections.	**6**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Plastic Analysis:** Plastic bending of beams, plastic hinge, upper and lower bond theorems, uniqueness theorem, yield criteria, analysis and design of fixed and continuous beams	**5**
Unit 2	**Design of Portal frames:** Plastic analysis, Collapse mechanism, analysis and design of Gables, multistorey- multi bay frames, checks for stability of frames, plastic moment distribution method.	**6**
Unit 3	**Design of Pre-Engineered Buildings:** Applications of PEB, Components of PEB, Analysis of PEB frame under the influence of dead, live, collateral, wind, seismic loads. Serviceability limits as per code, PEB design methodology, Design parameters of PEB frames, Section sizes as per manufacturing limitations, Analysis and Design of Rigid Frame.	**7**
Unit 4	**Design of truss girder bridge:** Types of truss bridges, component part of a truss bridges, Self-weight of truss girder, design of bridge, compression member, Tension member, wind load on truss girder bridges, wind effect on top lateral bracing, portal bracing, sway bracing.	**7**

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Unit 5	**Design of steel beams with web openings:** Shape of web openings, Practical guidelines, Force distribution and failure pattern, Analysis of beam with perforated thin and thick webs, Design of laterally restrained beams for given sectional properties, Vierendeel girders	**6**
Unit 6	**Cold formed light gauge steel sections:** Techniques and properties, Advantages, Typical profiles, Stiffened and un stiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions-numerical examples, beam design.	**5**
	Total Hours	**36**

Codes of practice:	
1.	IS 800 (2007) General construction in steel -Code of practice, Bureau of Indian Standard.
2.	IS: 875 (Part3) (2015), Wind load on Buildings and Structures, Bureau of Indian Standard.
3.	Handbook No. 1(SP 16) or Steel table, (1964), Handbook for Structural Engineers, Bureau of Indian Standard.
Text Books:	
1	Duggal S. K., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
2	Sairam K. S. "Design of Steel Structures", Pearson Publication.
3	Shah V. L & Gore V, "Limit state Design of Steel Structures", Structures Publication.
4	Gambhir, "Fundamentals of Structural Steel Design", Tata McGraw Hill Pub. Co. Ltd., New Delhi
Reference Books:	
1	N. Subramanian, "Design of Steel Structures", Oxford University Press.
2	Chandra Ram, "Design of Steel Structures", Vol. I & Vol. II, Standard Book House, New Delhi
3	Dayaratnam P., "Design of Steel Structures", Wheeler Publishing, New Delhi
4	Vazirani V.N. and Ratwani M.M., "Design and Analysis of Steel Structures", ISBN NO: 978-81-7409-295-3
5.	Gaylord E.H. and Gaylord C.N., "Design of Steel Structures" McGraw Hill, New York

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Design of Industrial Structures

Course Code and Course Title	0CEPEC553 Design Of Industrial Structures			
Semester	II			
Prerequisites	Design of Steel Structures and Structural Analysis.			
Teaching Scheme (hours per week)	Lecture	Tutorial	Practical	
	3	-	-	
Credit	03			
Evaluation Scheme	ISE 1	MSE	ISE 2	ESE
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:		**BL**
CO1	Apply knowledge of structural behavior and codal provisions to plan industrial structures efficiently.	**3**
CO2	Analyze thin-walled/cold-formed steel members for buckling, compression, and tension.	**4**
CO3	Analyze RC bunkers, silos, and chimneys under self-weight, wind, and temperature effects.	**4**
CO4	Evaluate design solutions for cylindrical shells and complex industrial components.	**5**
CO5	Create safe and optimized designs of industrial structures using advanced design principles and structural detailing.	**6**

Course Content

Unit No.	Contents	Hrs.
Unit 1	**Planning of Industrial Structures:** Covers types and components of industrial structures, layout planning, bracings, and design principles of steel industrial buildings.	**6**
Unit 2	**Cold-Formed / Thin-Walled Steel Members:** Focuses on local and post-buckling behavior, light-gauge columns and compression members, stiffened elements, effective length considerations, and tension members.	**6**
Unit 3	**RC Bunkers & Silos**: Introduces Janssen's and Airy's theories for pressure distribution and design of square, rectangular, and circular bunkers and silos.	**6**
Unit 4	**RC Chimneys**: self-weight, wind, and temperature-induced stresses, combined loading effects, and design of shaft and horizontal reinforcement.	**6**
Unit 5	**Cylindrical Shells:** Covers design principles, stress distribution, stability considerations, and practical design problems of cylindrical shells.	**6**

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Unit 6	**Design Integration & Case Studies**: Integrates concepts from all units, emphasizing hybrid systems, optimization strategies, and case studies of industrial plants, silos, and chimneys.	**6**
	Total Hours	**36**

Text Books:

1. N. Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers, 2005.
2. Ram Chandra & Virendra Gehlot, Design of Steel Structures, Vol-II, 2007.
3. Duggal, Design of Steel Structures, Tata McGraw-Hill, 2010.

Reference Books:

1. Mallick & Gupta, Design of Industrial Structures, Tata McGraw-Hill, 2015.
2. P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford & IBH, 2010.
3. IS Codes: IS 456, IS 800, IS 4995, IS 875.

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Theory of Plates and Shell

Course Code and Course Title	**0CEPEC553 Theory of Plates and Shells**			
Semester	II			
Prerequisites	Structural Analysis.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	03	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:		**BL**
CO1	Understand and derive governing differential equation for deflected shape of rectangular plates.	**1**
CO2	Solve governing differential equation of deflected shape of rectangular plate for various loading and support conditions.	**3**
CO3	Understand and derive governing differential equation for deflected shape of rectangular plates.	**2**
CO4	Solve governing differential equation of deflected shape of rectangular plate for various loading and support conditions.	**3**
CO5	Understand and derive governing differential equation for deflected shape of circular plates	**2**
CO6	Understand membrane theory for internal forces in different shells.	**2**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Introduction to Plate Theory:** Thin and Thick Plates, Small and Large Deflection Theory of Thin Plate, Assumptions in Analysis of Thin Plates, Slope Curvature Relations, Moment - Curvature Relations, Stress Resultants, Governing Differential Equations for Bending of Plates, Various Boundary Condit	6
Unit 2	**Navier's and Levy's Solution:** Analysis of Rectangular Plates Subjected to various loading, Navier's method of solution for simply supported plates, Leavy's method of Solution for plates under different boundary conditions.	6

Unit 3	**Circular Plates:** Analysis of Circular Plates under Axis-Symmetric Loading, Moment Curvature Relations, Governing Differential Equation in Polar Co-Ordinates, Simply Supported and Fixed Edges, Distributed Load, Ring Load, a Plate with Hole at Centre. Numerical examples	6
Unit 4	**Theory of shells:** **Introduction to Shell Structures:** Classification of Shells on basis of Geometry, Thin Shell Theory, Equation of Shell Surfaces, Stress Resultants, Stress Displacement Relations, Compatibility and Equilibrium Equations.	6
Unit 5	**Membrane Analysis:** Equation of Equilibrium for Synclastic Shells, Solution for Shells Subjected to Weight and Live Load, Cylindrical Shells - Equation of Equilibrium, Open Shells with Parabolic, Circular, Elliptical Directrix, Simple Problems, Shells with Closed Directrix-Circular, Elliptical-Simple Problems, Problems on Pipes Carrying Fluid/Liquid Under Pressure.	6
Unit 6	**Bending of Cylindrical Shells:** Symmetrically Loaded Circular Cylindrical Shells, Beam Theory, Finster walder's Theory, D.K.J. Theory- Donnell's Equation, Characteristic Equation, Schorer's Theory.	6
	Total Hours	**36**

Text Books:

1. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Grew Hill.
2. Chandrasekhara K., Analysis of Plates, New Age International Edition
3. Chandrasekhara K., Analysis of Concrete Shells, New Age International Edition

Reference Books:

1. Ansel C. Ugural, Stresses in Plates and Shells, Mc Graw Hill.
2. G. S Ramaswamy, Design and Construction of Concrete Shell Roofs, CBS Publications.
3. Reddy, J. N.; Theory and Analysis of Elastic Plates and Shells, Taylor & Francis.
4. Ugural, A. C. "Stresses in Plates and Shells", 2nd edition, McGraw-Hill, 1999.

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Applications of ALML in Structural Engineering

Course Code and Course Title	**0CEPEC554 Application Of Artificial Intelligence and Machine Learning in Structural Engineering**			
Semester	II			
Prerequisites	Basic knowledge of structural analysis, dynamics, probability and statistics, and MATLAB programming fundamentals.			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:		**BL**
CO1	Explain the fundamental concepts of Artificial Intelligence and Machine Learning relevant to structural engineering.	**2**
CO2	Preprocess and analyze structural datasets using data-driven and feature engineering techniques.	**3**
CO3	Apply Machine Learning algorithms for prediction, classification, and clustering in structural problems.	**3**
CO4	Develop and analyze deep learning models such as ANN, CNN, and RNN for structural applications.	**4**
CO5	Evaluate AI/ML-based approaches for structural health monitoring, optimization, and reliability assessment.	**5**

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	Introduction to AI/ML in Structural Engineering: Overview of Artificial Intelligence and Machine Learning; Data-driven approaches in civil and structural engineering; Role of AI/ML in analysis, design automation, and monitoring; Supervised and unsupervised learning fundamentals.	**6**
Unit 2	**Data for Structural Engineering:** Types of structural datasets: experimental, field monitoring, and numerical (FEA); Data pre-processing, cleaning, normalization, and transformation; Feature extraction, dimensionality reduction, and dataset preparation for ML models.	**6**

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Unit 3	**ML Algorithms for Structural Problems**: Regression and classification techniques, clustering methods, and pattern recognition; Applications in load–response prediction, damage detection, and material property estimation; Evaluation metrics for model performance.	**6**
Unit 4	**Deep Learning Applications:** Fundamentals of Artificial Neural Networks (ANN); Convolutional Neural Networks (CNN) for crack and defect detection (image-based); Recurrent Neural Networks (RNN) and LSTM models for time-dependent and vibration response prediction.	**6**
Unit 5	**AI in Structural Health Monitoring and Optimization: AI** and ML in SHM, life-cycle prediction, and residual strength assessment; Optimization-based design using AI; Applications in reliability analysis, structural maintenance, and smart infrastructure systems.	**6**
Unit 6	**Tools, Integration, and Future Trends:** AI/ML implementation using MATLAB; Integration with structural software (ETABS, ABAQUS); Challenges, limitations, and ethical use of AI in civil engineering; Emerging trends in digital twins and intelligent structures.	**6**
Total Hours		**36**

Text Books:

1. S. Rajasekaran, Structural Health Monitoring with AI Techniques, Springer, 2019.
2. C. S. Krishnamoorthy, Artificial Intelligence and Expert Systems for Engineers, CRC Press, 1996.
3. D. Boström, Applied Machine Learning for Civil and Structural Engineers, Wiley, 2021.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
2. Hastie, Tibshirani, Friedman, The Elements of Statistical Learning, Springer, 2017.
3. M. Z. Naser, AI and Machine Learning in Civil Engineering, Elsevier, 2024.
4. IS 1893, IS 456, and IRC Codes (for case-based applications and dataset modeling).

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Structural Health Monitoring and Audit

Course Code and Course Title	0CEPEC554 Structural Health Monitoring and Audit			
Semester	II			
Prerequisites	Basic knowledge of structural analysis, design of concrete and steel structures, and civil engineering materials.			
Teaching Scheme (hours per week)	Lecture	Tutorial	Practical	
	3	-	-	
Credit	03			
Evaluation Scheme	ISE 1	MSE	ISE 2	ESE
	10 Marks	20 Marks	10 Marks	60 Marks

	Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:	BL
CO1	Apply knowledge of structural behavior to diagnose distress and identify influencing factors affecting performance.	3
CO2	Analyze structural health using static field-testing methods and interpret assessment data.	4
CO3	Analyze dynamic response data and assess health using vibration-based and remote sensing techniques.	4
CO4	Evaluate and recommend suitable repair, strengthening, and rehabilitation strategies for distressed structures.	5
CO5	Create smart monitoring solutions using advanced materials and sensor technologies for continuous structural health monitoring.	6

Course Content

Unit No.	Contents	Hrs.
Unit 1	**Introduction to Structural Health and Distress:** Overview of structural health concepts and parameters affecting performance. Major causes of distress such as design errors, material degradation, and environmental effects. Significance of durability, service life assessment, maintenance, and sustainability in preserving structural integrity.	6
Unit 2	**Structural Health Monitoring:** Concept, importance, and basic methods of SHM. Visual inspection, NDT, and continuous monitoring approaches. Integration of SHM in design and operation phases. Applications in bridges, buildings, and heritage structures with focus on preventive maintenance.	6

Unit 3	**Structural Audit and Condition Assessment:** Principles and stages of structural audit—inspection, data collection, analysis, and reporting. Use of grading systems for condition evaluation. Investigation procedures for distress or collapse. Reference to IS codes and preparation of audit documentation	**6**
Unit 4	**Static Field Testing and Instrumentation:** Fundamentals of static testing and load assessment. Basic loading arrangements, use of strain gauges, displacement and crack measurement tools. Data acquisition and comparison with analytical models for validation and safety assessment.	**6**
Unit 5	**Dynamic Field Testing and Smart Monitoring:** Concepts of dynamic testing, vibration analysis, and modal studies. Overview of ambient and forced vibration tests. Introduction to remote sensing, wireless sensors, and data acquisition systems for real-time health monitoring.	**6**
Unit 6	**Repairs, Rehabilitation, and Smart Materials:** Essential repair and retrofitting techniques including jacketing and FRP wrapping. Brief case examples of rehabilitation practices. Introduction to piezoelectric and EMI-based smart sensing materials. Emphasis on sustainable and performance-based maintenance.	**6**
Laboratory / Field Component (NEP 2020 Suggested): Mini-project on structural audit or SHM study; demonstration of NDT tools and sensors; data collection, interpretation, and short report on rehabilitation measures.		
Total Hours		**36**

Text Books:

1. Daniel Balageas, Claus-Peter Fritzen, and Alfredo Güemes, Structural Health Monitoring, John Wiley & Sons, 2006.
2. Douglas E. Adams, Health Monitoring of Structural Materials and Components – Methods with Applications, Wiley, 2007

Reference Books:

1. J. P. Ou, H. Li, and Z. D. Duan, Structural Health Monitoring and Intelligent Infrastructure (Vol. 1), Taylor & Francis, 2006.
2. Victor Giurgiutiu, Structural Health Monitoring with Piezoelectric Wafer Active Sensors, Academic Press, 2007.
3. Rolf Eligehausen & fib Bulletin 24, Monitoring and Assessment of Structures, Federation Internationale du Béton (fib), 2003.
4. J. H. Bungey and S. G. Millard, Testing of Concrete in Structures, Taylor & Francis, 2014.
5. **IS Codes:** IS 15988, IS 13935, IS 13311.

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Advanced Construction Materials

Course Code and Course Title	**0CEPEC554 Advanced Construction Material.**			
Semester	II			
Pre-requisites	Basics of material science			
Teaching Scheme (hours per week)	**Lecture**	**Tutorial**	**Practical**	
	02	-	-	
Credit	02			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (COs): -Upon successful completion of this course, the student will able to:		**BL**
CO1	Select suitable advanced materials for specific engineering applications.	5
CO2	Integrate sustainability and smart technology into material design.	4
CO3	Conduct laboratory and field-level assessment of new materials	4

Course Content

Unit No.	**Contents**	**Hrs.**
Unit 1	**Sustainable and Green Construction Materials** Principles of sustainable materials design and life-cycle analysis (LCA), Use of industrial by-products: fly ash, GGBS, red mud, rice husk ash, Alkali-activated binders and geopolymer concrete, Recycled aggregates, construction and demolition (C&D) waste utilization, Low-carbon cements and carbon capture in construction materials, Introduction to advanced concretes-High Strength concrete, High performance concrete, Fibre reinforced concrete, Self-compacting concrete.	6
Unit 2	**Smart and Functional Materials** Smart materials in civil engineering: overview and types, Self-sensing, self-healing, and self-cleaning materials, Photo catalytic concrete and hydrophobic coatings, Shape memory alloys and their structural applications, Embedded sensors and smart concrete systems for structural health monitoring (SHM).	6
Unit 3	**Advanced Metallic, Polymeric, and Composite Materials** High-performance steel and aluminium alloys in construction, Corrosion-resistant and weathering steels, Advanced polymers and FRP composites: manufacturing, mechanical behaviour, and field applications, Nano-materials and Nano-modified composites, Hybrid composites and sandwich panels for lightweight structures.	6

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Unit 4	**Testing, Characterization, and Field Applications** Micro structural characterization: SEM, XRD, FTIR, and TGA, Mechanical and durability testing of advanced materials, Non-destructive testing (NDT) and evaluation methods. Field applications and performance monitoring of advanced materials, Case studies from recent research and mega infrastructure projects	**6**
Total Hours		**24**

Reference Book:

1. Mehta, P.K. and Monteiro, P.J.M., Concrete: Microstructure, Properties, and Materials, McGraw-Hill.
2. . Gambhir, M.L., Concrete Technology, Tata McGraw-Hill.
3. Mindess, S. and Young, J.F., Concrete, Prentice Hall
4. Nawy, E.G., High Performance Concrete: Technology and Applications, CRC Press.
5. Neville, A.M., Properties of Concrete, Pearson Education
6. Advanced Civil Infrastructure Materials — Hwai-Chung Wu (Elsevier)

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Structural Optimization

Course Code and Course Title	**0CEOEC555 Structural Optimization**			
Semester	II			
Pre-requisite's	1)Engineering Mathematics (optimization basics, matrices, calculus) 2)Computer Applications in Civil Engineering (basic programming and numerical methods)			
Teaching Scheme (Hours per week)	Lecture	Tutorial	Practical	
	03	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO's): - Upon successful completion of this course, the student will be able to:		**BL**
CO 1	Explain the fundamental concepts of optimization and formulate engineering problems as mathematical programming models.	**2**
CO 2	Apply classical and linear programming techniques to solve single and multivariable structural optimization problems.	**3**
CO 3	Utilize non-linear and constrained optimization methods to analyse and optimize structural systems.	**4**
CO4	Employ advanced optimization techniques such as geometric and dynamic programming for solving complex structural design problems.	**5**

Course Content		**Hrs**
Unit 1	Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems. Optimization Techniques: Classical optimization techniques, single variable optimization, multivariable optimization with no constraints, unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques	**08**
Unit 2	Linear Programming: Linear programming, standard form of linear programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, revised simpler methods, duality in linear programming.	**06**

Unit 3	Non-linear programming: Non-linear programming, one dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, descent methods	**06**
Unit 4	Constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different technique.	**06**
Unit 5	Geometric programming: Geometric programming, conversion of NLP as a sequence of LP / geometric programming.	**06**
Unit 6	Dynamic programming: Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming.	**04**
Total Hours		**36**

Text Books:

1	Spunt, L. (1971). Optimum Structural Design. Prentice Hall.
2	Rao, S. S. (1978). Optimization – Theory and Practice. Wiley Eastern Ltd.
3	Kirsch, U. (1981). Optimum Structural Design. McGraw-Hill, New York.
4	Bronson, R., & Govindsami, N. (2017). Operations Research. Schaum's Outline Series.

Reference Books:

1	Bhavikatti, S. S. (2003). Structural Optimization Using Sequential Linear Programming. Vikas Publishing.
2	Fox, R. L. (1971). Optimization Methods for Engineering Design. Addison-Wesley.
3	Deo, N. (1989). System Simulation with Digital Computer. Prentice Hall of India, New Delhi.
4	Stark, R. M., & Nicholls, R. L. (1972). Mathematical Foundations for Design. McGraw-Hill, New York.

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Industrial Safety

Course Code and Course Title	**0CEOEC555 Industrial Safety**			
Semester	II			
Pre-requisite's	1)Engineering Mathematics (optimization basics, matrices, calculus) 2)Computer Applications in Civil Engineering (basic programming and numerical methods)			
Teaching Scheme (Hours per week)	Lecture	Tutorial	Practical	
	03	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO's): - Upon successful completion of this course, the student will be able to:		**BL**
CO 1	Understand the importance and scope of safety in structural engineering	**2**
CO 2	Apply safety principles in design and construction phases	**3**
CO 3	Conduct risk assessment and safety audits effectively	**4**
CO4	Interpret legal requirements and safety codes	**3**
CO5	Integrate digital tools and sustainability in safety planning	**5**
CO6	Design and propose safety improvement measures for real projects	**6**

Course Content		**Hrs**
Unit 1	Introduction to Industrial & Construction Safety Importance and objectives of safety in structural engineering. Types of hazards: physical, mechanical, chemical, and ergonomic. Accident causation theories and analysis. Concepts of hazard, risk, and safety culture. Case studies: Major industrial/structural accidents and lessons learned.	**06**
Unit 2	Safety in Structural Design Principles of design for safety and reliability. Design considerations for earthquake, fire, and wind safety. Fail-safe and redundancy in design. Role of design engineer in ensuring construction safety. Design stage risk identification and mitigation planning.	**06**

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Unit 3	Construction Site Safety Management Safety in formwork, scaffolding, concreting, and erection. Lifting operations and material handling safety. Working at heights, excavation safety, confined space safety. PPE (Personal Protective Equipment) and safety signage. Site layout and traffic management for safe operation.	**06**
Unit 4	Risk Assessment and Safety Systems Risk identification, evaluation, and control hierarchy. Techniques: Job Safety Analysis (JSA), FMEA, HAZOP, Fault Tree Analysis. Safety management systems: OHSAS 18001, ISO 45001. Accident investigation and root cause analysis. Documentation, inspection, and safety audit procedures.	**06**
Unit 5	Legal Framework, Standards, and Regulations Indian Factories Act, BOCW Act, and Contract Labour Act. BIS codes for construction safety (IS 3764, IS 7205, IS 7293, IS 14687). OSHA and ILO guidelines. Safety certification, statutory approvals, and reporting procedures. Roles and responsibilities of engineers, contractors, and clients.	**06**
Unit 6	Emerging Technologies & Sustainable Safety Practices Digital safety management using BIM, drones, IoT, and AI. Monitoring and predictive analytics for accident prevention. Disaster preparedness, emergency response, and evacuation planning. Ethical and sustainable aspects of safety in design and construction. Case studies on innovative safety practices in structural projects.	**06**
Total Hours		**36**

Reference Books:

1	K. U. Mistry, Safety and Accident Prevention in Engineering Industries, McGraw Hill.
2	John Ridley, Safety at Work, Routledge.
3	S. L. Goel, Construction Safety Management, New Age International.
4	R. Choudhury, Construction Safety Management and Engineering, McGraw Hill.
5	ILO and OSHA Manuals on Occupational Safety and Health.
6	BIS Handbook SP 70 – Safety in Construction.
7	Relevant IS Codes: IS 3764, IS 7205, IS 7293, IS 14687.

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Project Management in Structural Engineering

Course Code and Course Title	**0CEOEC555 Project Management in Structural Engineering**			
Semester	II			
Pre-requisite's	1)Engineering Mathematics (optimization basics, matrices, calculus) 2)Computer Applications in Civil Engineering (basic programming and numerical methods)			
Teaching Scheme (Hours per week)	Lecture	Tutorial	Practical	
	03	-	-	
Credit	03			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO's): - Upon successful completion of this course, the student will be able to:		**BL**
CO 1	Demonstrate understanding of project management principles applied to structural engineering projects.	**2**
CO 2	Develop detailed project schedules and control systems using CPM, PERT, and BIM tools.	**6**
CO 3	Optimize structural resources and cost through effective planning and monitoring.	**5**
CO4	Assess and mitigate risks related to structural design, construction safety, and quality.	**5**
CO5	Apply sustainability, digital tools, and performance management approaches in structural projects.	**3**

Course Content		**Hrs**
Unit 1	**Fundamentals of Project Management in Structural Engineering** • Concept, objectives, and characteristics of engineering projects • Classification of projects: structural, infrastructure, industrial, and special structures • Project life cycle phases: feasibility, design, construction, operation, and maintenance • Role of structural engineer in project management and coordination with other disciplines • Organizational structures for structural projects (functional, matrix, and projectized) • Case studies: bridges, high-rise buildings, industrial sheds, and precast structures	**06**

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Unit 2	**Project Planning and Scheduling for Structural Works** • Work Breakdown Structure (WBS) and sequencing of structural activities (foundation to superstructure) • CPM and PERT analysis with examples related to RCC and steel structures • Time–cost optimization and crashing of structural project networks • Gantt charts, milestone charts, and line of balance techniques • Application of software: MS Project, Primavera, and BIM-based planning • Case study: planning a reinforced concrete frame structure project	**08**
Unit 3	**Resource, Cost, and Financial Management** • Material, manpower, and equipment management for structural works • Resource levelling and resource smoothing in multi-storey building construction • Estimation and cost control for structural components (footing, columns, beams, slabs, etc.) • Cash flow forecasting and earned value analysis (EVA) • Cost overrun analysis and control strategies • Value Engineering in structural projects	**08**
Unit 4	**Risk, Quality, and Safety Management in Structural Projects** • Identification and classification of risks in structural design and execution • Design risk (loading assumptions, detailing errors) vs. construction risk (formwork failure, curing issues) • Safety protocols during erection of steel and RCC structures • Quality assurance and control: concrete testing, NDT, structural audit, and documentation • Legal and contractual frameworks in structural construction projects (BIS codes, contract clauses) • Case study: structural failure analysis and risk lessons learned	**07**
Unit 5	**Advanced and Emerging Tools in Structural Project Management** • Building Information Modelling (BIM) in structural coordination • 4D and 5D BIM for project visualization, scheduling, and costing • Digital Twin concept for lifecycle management of structures • Use of AI and IoT in structural health monitoring and predictive maintenance • Sustainable structural project management: lifecycle cost analysis, embodied carbon assessment • Integration of safety, quality, and environmental performance indicators	**06**

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Unit 6	**Case Studies and Industry Practices** • Project management approach in iconic Indian structural projects (bridges, metro viaducts, towers) • Challenges in fast-track construction projects • Performance evaluation of project management systems in structural engineering firms • Guest lectures / seminars from industry experts	**05**
Total Hours		**36**

Reference Books:	
1	Chitkara, K.K. – Construction Project Management: Planning, Scheduling and Controlling, Tata McGraw Hill.
2	2. Kerzner, H. – Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Wiley.
3	3. Punmia & Khandelwal – Project Planning and Control with PERT and CPM, Laxmi Publications.
4	4. Oberlender, G.D. – Project Management for Engineering and Construction, McGraw-Hill.
5	5. PMI – PMBOK® Guide (7th Edition), Project Management Institute.
6	6. Raina, V.K. – Concrete Bridge Practice: Construction, Maintenance, and Rehabilitation, Shroff Publishers.
7	7. IS 15883 (Part 1–7) – Guidelines for Construction Project Management.

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Mini Project

Course Code and Course Title		0CEVSE556 Mini Project		
Semester		II		
Prerequisites		-		
Teaching Scheme (hours per week)		Lecture	Tutorial	Practical
		-	-	4
Credit		02		
Evaluation Scheme		ISE 1		ISE 2
		25 Marks		25 Marks

Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:		**BL**
CO1	Identify relevant research problems in structural engineering through literature review	**4**
CO2	Formulate clear and concise objectives	**5**
CO 3	Analyze structural engineering problems using appropriate tools and techniques	**4**
CO 4	Validate the results of research work from literature by principle of replication	**5**
CO5	Prepare a detailed technical report and present project findings clearly and confidently	**5**

Course Content

Note:

The 'Mini Project' course offers students an opportunity to explore advanced topics in structural engineering. Students choose a topic in consultation with their supervisor, focusing on dissertation work, societal problems, or special structures using standard software. The students should apply any tool such as software, mathematical method, and development of programming, experimental method or solving selected problem. Here parametric study is not expected. This course emphasizes practical application, fostering skills such as problem identification, report preparation, and effective communication. Students are expected to develop lifelong learning abilities and deliver presentations, showcasing their findings. A comprehensive report must be submitted to the Department Post Graduate Committee in both hard and soft copy formats.

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Software Applications in Civil Engineering Lab II

Course Code and Course Title		**0CEAEC557 Software Application in Civil Engineering8 Lab-II**		
Semester		II		
Prerequisites		Basic knowledge of structural analysis and design		
Teaching Scheme (hours per week)		**Lecture**	**Tutorial**	**Practical**
		-	-	4
Credit		02		
Evaluation Scheme		**ISE 1**		**ISE 2**
		25 Marks		25 Marks
Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:				**BL**
CO1	Analyze steel structural systems (truss, tower, frame, hoarding, etc.) using standard software and IS codes.			**4**
CO2	Design structural members and connections as per IS 800:2007 using software and manual validation.			**4**
CO3	Prepare detailing drawings, interpret results, and compile a professional design report.			**6**
Course Content				
Unit No.	**Contents**			**Hrs.**
	Activity 1: Analysis of Steel Structures using Software • Introduction to structural analysis tools (STAAD. Pro / ETABS / SAP2000). • Modeling and analysis of one of the following structures: o Roof truss o Transmission / Telecom tower o Steel building frame / Industrial shed o Hoarding / Billboard support structure • Application of loads (DL, LL, WL) as per IS 875. • Extraction and interpretation of analysis results (member forces, reactions, deflections). • Validation of software output with theoretical calculations. Deliverables: Model file, load application sheet, analysis report (member forces & deflection summary)			**14**

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	Activity 2: Design and Detailing of Steel Structures • Design of structural members as per IS 800:2007 (Limit State Method): o Tension and compression members o Beams, columns, and base plates o Welded and bolted connections • Preparation of structural detailing drawings using AutoCAD / Tekla. • Compilation of design report and presentation of results. Deliverables: Design calculations, detailing drawings, final report, and presentation.	**14**
	Viva-Voce / Presentation / Report Submission • Oral examination and evaluation of analytical and design work. • Assessment of report preparation, teamwork, and presentation skills.	**8**
	Note: Students shall select any one of the mentioned steel structures (Roof Truss / Tower / Frame / Hoarding) and perform both mandatory activities — **1. Analysis, and** **2. Design & Detailing —** **for the same selected structure.**	
	Total Hours	**36**

Text Books:

1. S.K. Duggal, Limit State Design of Steel Structures, McGraw-Hill.
2. N. Subramanian, Design of Steel Structures, Oxford University Press.
3. IS 800:2007, General Construction in Steel – Code of Practice.
4. IS 875 (Part I–V), Loading Standards.

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Innovation, Entrepreneurship & Start-up Management

Course Code and Course Title	**0CEEEM558 Innovation, Entrepreneurship & Start-up Management**			
Prerequisites	Basics of Management, Engineering Economics			
Teaching Scheme	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	**03**			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO) Upon successful completion of this course, the student will be able to:		**BTL**
CO1	**Apply** the concepts of innovation, creativity, and design thinking to develop new product and service ideas	**3**
CO2	**Analyze** entrepreneurial opportunities, business models, and market feasibility for start-ups	**4**
CO3	**Evaluate** funding options, financial planning, and risk management strategies for entrepreneurial ventures	**5**
CO4	**Apply** knowledge of legal, ethical, and intellectual property (IPR) frameworks to start-up management	**3**
CO5	**Assess** strategies for scaling, sustainability, and leadership in entrepreneurship through case studies of successful start-ups	**5**

Course Content		**Hrs**
Unit 1	**Fundamentals of Innovation & Entrepreneurship** Concept of innovation and entrepreneurship, Types of innovation, Creativity and idea generation techniques, Role of entrepreneurship in economic development, Intrapreneurship.	**07**
Unit 2	**Business Models & Opportunity Identification** Business model canvas, Value proposition, Customer development, Market analysis, Identifying business opportunities, Feasibility analysis.	**06**
Unit 3	**Start-up Ecosystem & Funding** Start-up life cycle, Start-up India initiative, Incubators and accelerators, Angel investors, Venture capital, Crowdfunding, Government policies and schemes.	**06**
Unit 4	**Business Planning & Risk Management** Components of a business plan, Financial planning and projections, Technology commercialization, Managing risks and uncertainties, Exit strategies.	**06**
Unit 5	**Innovation for Sustainability & Social Entrepreneurship** Sustainable business models, Social entrepreneurship, Green innovations, Circular economy opportunities.	**06**

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Unit 6	**Leadership, IPR, and Case Studies** Intellectual property in entrepreneurship, Leadership in start-ups, Strategic growth management, Case studies of successful innovations and start-ups.	**06**
	Total Hours	**37**

Text Books:	
1	S.S. Khanka, Entrepreneurial Development, S. Chand & Co.
2	Peter F. Drucker, Innovation and Entrepreneurship, Harper Business.
3	Vijay Govindarajan & Chris Trimble, The Other Side of Innovation, Harvard Business Review Press
Reference Books:	
1	Barringer & Ireland, Entrepreneurship: Successfully Launching New Ventures, Pearson.
2	Timmons & Spinelli, New Venture Creation: Entrepreneurship for the 21st Century, McGraw-Hill.
3	Ries, Eric, The Lean Startup, Crown Publishing.
4	Hisrich, Peters & Shepherd, Entrepreneurship, McGraw-Hill.

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Project Management & Strategic Planning

Course Code and Course Title	0CEEEM558 Project Management & Strategic Planning			
Prerequisites	Basics of Management, Engineering Economics, Operations Management			
Teaching Scheme	Lecture	Tutorial	Practical	
	3	-	-	
Credits	03			
Evaluation Scheme	ISE 1	MSE	ISE 2	ESE
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO) Upon successful completion of this course, the student will be able to:		BTL
CO1	**Apply** principles of project management, life cycle, and project organization.	3
CO2	**Apply** project planning, scheduling, resource allocation, and cost estimation techniques.	3
CO3	**Analyze** project risks, quality, and performance metrics for effective decision-making.	4
CO4	**Demonstrate** knowledge of strategic planning, portfolio management, and project alignment with business objectives.	3
CO5	**Design** project management frameworks for real-world engineering and industrial projects, ensuring sustainability and efficiency.	5

Course Contents

Unit No	Contents	Hrs
Unit 1	**Fundamentals of Project Management** Introduction to projects and project management, project life cycle, roles and responsibilities, project organization structures, project objectives and scope, project selection methods.	07
Unit 2	**Project Planning and Scheduling** Work Breakdown Structure (WBS), Gantt charts, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), resource allocation, cost estimation, budgeting.	06
Unit 3	**Project Risk Management** Risk identification, risk assessment methods, qualitative and quantitative risk analysis, risk mitigation strategies, contingency planning.	06
Unit 4	**Project Quality and Performance Management** Quality management principles, Six Sigma, Total Quality Management (TQM), Key Performance Indicators (KPIs), Earned Value Management (EVM), project monitoring and control techniques.	07

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Unit 5	**Strategic Planning & Project Alignment** Strategic planning process, mission, vision, and objectives; Portfolio and program management, project prioritization, alignment of projects with business strategy, decision-making models.	**06**
Unit 6	**Applications and Contemporary Trends** Agile and Lean project management, project management software (MS Project, Primavera), sustainable project management, case studies of engineering projects, global trends and best practices.	**07**
	Total Hours	**39**

Text Books:	
1	Meredith, J.R., Mantel, S.J. – Project Management: A Managerial Approach, Wiley.
2	Kerzner, H. – Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Wiley.
3	Cleland, D.I., Ireland, L.R. – Project Management: Strategic Design and Implementation, McGraw-Hill.
Reference Books:	
1	Pinto, J.K. – Project Management: Achieving Competitive Advantage, Pearson.
2	Schwalbe, K. – Information Technology Project Management, Cengage.
3	PMI – A Guide to the Project Management Body of Knowledge (PMBOK® Guide), PMI Publications.
4	Gido, J., Clements, J. – Successful Project Management, Cengage.

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Engineering Economics & Cost Analysis

Course Code and Course Title	**0CEEEM558 Engineering Economics & Cost Analysis**			
Prerequisites	Basics of Economics, Mathematics, Fundamentals of Engineering Management			
Teaching Scheme	**Lecture**	**Tutorial**	**Practical**	
	3	-	-	
Credits	**03**			
Evaluation Scheme	**ISE 1**	**MSE**	**ISE 2**	**ESE**
	10 Marks	20 Marks	10 Marks	60 Marks

Course Outcomes (CO) Upon successful completion of this course, the student will be able to:		**BTL**
CO1	**Apply** principles of engineering economics, demand-supply analysis, and cost concepts in engineering decision-making.	**3**
CO2	**Analyze** cost estimation, cost-volume-profit relationships, and break-even analysis for projects.	**4**
CO3	**Evaluate** investment alternatives using capital budgeting techniques such as NPV, IRR, and Payback Period.	**5**
CO4	**Apply** knowledge of depreciation, inflation, and replacement analysis in economic evaluation.	**3**
CO5	**Assess** economic feasibility and sustainability of engineering projects through case studies and cost-benefit analysis.	**5**

Course Contents

Unit No	**Contents**	**Hrs**
Unit 1	**Fundamentals of Engineering Economics** Nature and scope of economics, demand and supply analysis, elasticity, cost concepts, types of costs, opportunity cost, time value of money, interest formulas.	**06**
Unit 2	**Cost Estimation and Analysis** Elements of cost, cost classification, cost estimation methods, cost-volume-profit (CVP) analysis, break-even analysis, marginal costing, contribution analysis	**06**
Unit 3	**Capital Budgeting & Investment Decisions** Methods of project evaluation: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost Ratio, Annual Equivalent Method. Decision under risk and uncertainty.	**07**
Unit 4	**Depreciation and Replacement Analysis** Depreciation concepts and methods: Straight-line, Declining Balance, Sum of Years' Digits, Units of Production. Replacement analysis of assets and equipment, inflation impact on cost analysis.	**07**

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Unit 5	**Cost-Benefit and Financial Analysis of Projects** Economic feasibility, life-cycle costing, cost-benefit analysis, sensitivity analysis, financial statements for project evaluation, working capital management.	**07**
Unit 6	**Applications and Case Studies** Applications in engineering projects, industrial case studies, sustainability and green economics in engineering decisions, contemporary issues in cost analysis and project economics.	**06**
	Total Hours	**39**

Text Books:	
1	Riggs, J.L., Bedworth, D.D., Randhawa, S.U. – Engineering Economics, McGraw-Hill.
2	Prasanna Chandra – Projects: Planning, Analysis, Selection, Financing, Implementation, and Review, McGraw-Hill.
3	Sullivan, W.G., Wicks, E.M., Koelling, C.P. – Engineering Economy, Pearson.
Reference Books:	
1	R.Paneer Selvam – Engineering Economics, PHI Learning.
2	Blank, L.T., Tarquin, A.J. – Engineering Economy, McGraw-Hill.
3	DeGarmo, E.P., Canada, J.R., Sullivan, W.G. – Engineering Economy, Macmillan.
4	Gupta, R.L. – Cost Accounting: Principles and Practice, Sultan Chand.

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Internship

Course Code and Course Title		**0CEINT604 Internship**		
Semester		III		
Prerequisites		-		
Teaching Scheme (hours per week)		**Lecture**	**Tutorial**	**Practical**
		-	-	4
Credit		02		
Evaluation Scheme		**ISE 1**		**ISE 2**
		50 Marks		50 Marks
Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:				**BL**
CO1	Execute a complete structural engineering project independently.			**6**
CO2	Apply advanced tools and techniques in structural design and analysis.			**4**
CO 3	Present results in a standard technical/research format.			**5**
CO 4	Develop skills required for industry or doctoral research.			**5**
Course Content				
	Note: • **4–6 weeks training in design offices or construction sites to gain practical exposure to structural systems, detailing, quality control, and software tools like ETABS/STAAD. Students should maintain a diary and submit a brief report.**			

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Seminar

Course Code and Course Title		**0CEAEC605 Seminar**		
Semester		III		
Prerequisites		-		
Teaching Scheme (hours per week)		**Lecture**	**Tutorial**	**Practical**
		-	-	2
Credit		01		
Evaluation Scheme		**ISE 1**		**ISE 2**
		25 Marks		25 Marks
Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:				**BL**
CO1	**Analyze and evaluate** technical literature, including research papers, journals, and patents, to identify research gaps and formulate meaningful research topics in Structural Engineering.			**5**
CO2	**Prepare and deliver** well-structured seminar reports and oral presentations, demonstrating effective communication, teamwork, and time management skills in technical forums			**6**
Course Content				
	Note: • **Seminar shall be presented on one of the advanced topics chosen in consultation with the supervisor.** • **Students must study latest literature. The concepts must be clearly understood and presented by the student.** • **The student should use all modern methods of presentation. The student expects minimum 03 presentations within period of semester.** • **A hard copy of the report should be submitted before delivering the seminar.** • **A copy of the report in soft form must be submitted to the Supervisor along with other details, if any.**			
Total Hours				**20**

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Dissertation Phase I

Course Code and Course Title		0CEDIS606 Dissertation Phase I		
Semester		II		
Prerequisites		Mini Project		
Teaching Scheme (hours per week)		Lecture	Tutorial	Practical
		-	-	16
Credit		08		
Evaluation Scheme		ISE 1	ISE 2	
		50 Marks	50 Marks	
Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:				**BL**
CO1	Identify and define research problems through comprehensive literature review, and formulate clear research objectives, scope, and suitable methodology in the chosen area of specialization.			**5**
CO2	Demonstrate effective technical writing, presentation, and ethical research practices with sound project management and independent problem-solving skills.			**6**
Course Content				
	Note: • **Students must maintain regular reporting with Dissertation supervisor regarding status of Dissertation.** • **Project-I is an integral part of the final project work. In this, the student shall complete the partial work of the project which will consist of problem statement, literature review, project overview, scheme of implementation that may include mathematical model/block diagram/ PERT chart, and layout and design of the proposed system/work.** • **As a part of the progress report of project-I work; the candidate shall deliver a presentation on progress of the work on the selected dissertation topic.** • **It is desired to publish the paper on the state of the art on the chosen topic in international conference/ journal.** • **The student shall submit the duly certified progress report of project -I in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.**			

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Internship

Course Code and Course Title		**0CEINT651 Internship**		
Semester		IV		
Prerequisites		-		
Teaching Scheme (hours per week)		**Lecture**	**Tutorial**	**Practical**
		-	-	04
Credit		02		
Evaluation Scheme		**ISE 1**		**ISE 2**
		50 Marks		50 Marks
Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:				**BL**
CO1	Execute a complete structural engineering project independently.			**6**
CO2	Apply advanced tools and techniques in structural design and analysis.			**4**
CO 3	Present results in a standard technical/research format.			**5**
CO 4	Develop skills required for industry or doctoral research.			**5**
Course Content				
	Note: **Students should work independently or in collaboration with design firms, construction companies, or research institutions on real-life problems related to structural analysis, design, testing, or optimization. The internship involves detailed study, data collection, structural modelling, and analysis using advanced tools such as ETABS, STAAD. Ro, ANSYS, or ABAQUS. Topics may include finite element modelling, seismic and wind analysis, bridge or high-rise design, retrofitting, or sustainable construction materials. Students are required to maintain a daily or weekly logbook, prepare a comprehensive technical report or dissertation, and present their findings before an internal and external evaluation committee. The focus is on developing technical competence, analytical thinking, research aptitude, and professional presentation skills.**			

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Dissertation Phase II

Course Code and Course Title		**0CEDIS652 Dissertation Phase II**		
Semester		IV		
Prerequisites		-		
Teaching Scheme (hours per week)		**Lecture**	**Tutorial**	**Practical**
		-	-	36
Credit		18		
Evaluation Scheme		**ISE 1**		**ISE 2**
		50 Marks		50 Marks
Course Outcomes (COs): - Upon successful completion of this course, the student will be able to:				**BL**
CO1	Formulate, apply, and refine research objectives using appropriate methodologies, modelling, or experimental techniques, and analyze results to address defined research problems in Structural Engineering.			**6**
CO2	Prepare and defend a comprehensive dissertation report through effective academic writing and oral presentation, demonstrating professional communication and critical reasoning skills.			**6**
Course Content				

I – Research Planning and Execution
- Refinement of research problem and objectives
- Detailed methodology, work plan, and scheduling
- Use of project management tools for monitoring progress

II – Experimental/Computational Work
- Experimental setup, data collection, and validation
- Application of analytical and simulation tools
- Ethical considerations in data collection and usage

III – Data Analysis and Results
- Application of statistical tools, error analysis, and result interpretation
- Comparative study with literature
- Discussion of findings and limitations

IV – Report Writing
- Dissertation structure, formatting guidelines
- Plagiarism check and corrections
- Reference management (IEEE/APA style)

V – Research Publication
- Preparation of manuscript for journals/conferences
- Review and revision based on feedback

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	• Presentation of findings in technical events **VI – Final Defence and Submission** • Preparation of presentation slides, figures, and tables • Mock presentation and Q&A practice • Final dissertation submission and viva-voce	
	Total Hours	**36**

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