



JSPM's
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)



Department of Civil Engineering
Structure & Syllabi
F. Y. M. Tech (2024 Pattern)
w.e.f. Academic Year 2024-2025



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Department of Civil Engineering

Vision

“To provide an excellent academic environment for students to become competent Civil Engineer.”

Mission

- To reinforce the students with fundamentals in Civil Engineering by providing scholarly and vibrant environment for successful careers.
- To explore and develop innovations that contributes to higher education, research and entrepreneurship development in applied domains of Civil Engineering.
- To serve society through knowledge and expertise in Civil Engineering.



Structural Engineers: Adding Value in Every Building.

- **Structural engineers** design the '*bones and muscles*' that create the form and shape of man-made structures
- **Structural engineers** concerned with the *design and physical integrity* of buildings and other large structures, like tunnels and bridges.
- **Structural engineers** understand and calculate the *stability, strength and rigidity and earthquake evaluation* of built structures for buildings and non-building structures.
- **Unlike architects**, who must focus on the appearance, shape, size and use of the building, **structural engineers**, must *solve technical problems*- and help the architect, achieve his or her vision for the project.



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Department of Civil Engineering

Program Outcomes (POs)

- Engineering Graduates will be able to:
 1. Independently carry out research/investigation and development work to solve practical problems.
 2. Write and present a substantial technical report/document.
 3. Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
 4. Recognize the responsibility and contribute for sustainable development of society.
 5. Demonstrate professional practice and ethics.



Highlights of the Syllabus

Curriculum of MTech in Structural Engineering Department is designed in consultation with:



Academic
Experts

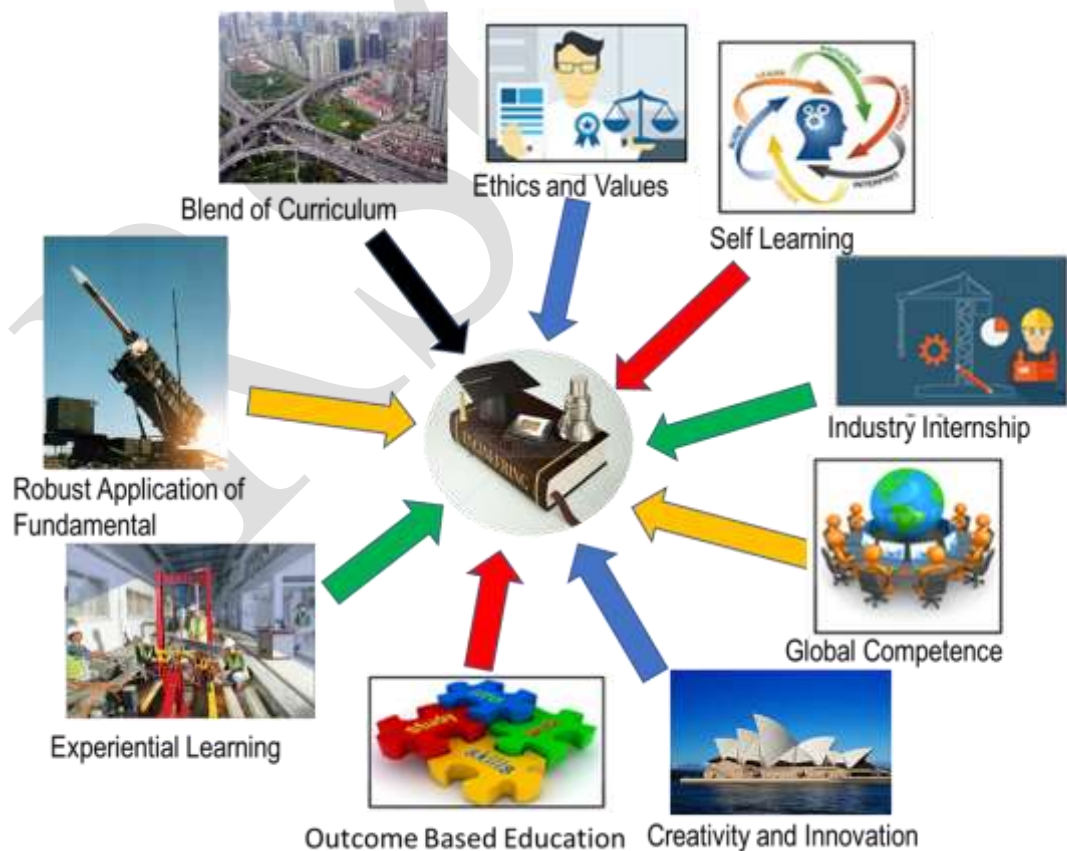


Distinguished
Alumni



Industry/Corporate Experts

The curriculum of the PG Program of Civil Engineering designed in association with the Bentley Systems; Construction Diagnostic Centre, Pune; G A Bhilare Consultants Private Limited, Pune; L&T Construction Ltd. Mumbai; Tata Consultancy Services Limited, Pune; Mercedes-Benz India Pvt Ltd, Pune.



Unique features of the curriculum

1. Curriculum centered at Outcome Based Education:

The new Curriculum is based on student-centered instruction models that focus on measuring student performance through outcomes. The outcomes include subject knowledge, industry required skills and aptitude development of students.

2. Robust application of Fundamentals:

The nature of the new curriculum is rigorous and well prescribed so that the students can spend more time on preparation and self-study. The students have to apply knowledge of core subjects, solve practical based assignments and must attempt periodical quizzes. This will benefit them to utilize and keep a strong hold on fundamentals of applied Engineering in the most effective way.

3. Experiential Learning:

The curriculum emphasizes on hands-on sessions along with theoretical information. The new curriculum considers Problem Based Experiential Learning (PBL) as a teaching pedagogy and includes different subjects that encourage the students for hands on learning through virtual labs, mini-projects, and literature and field surveys. Accordingly, the curriculum maintains good balance between theory and laboratory credits.

4. Promote Creativity and Innovation:

Along with experiential learning, the curriculum also motivates the students to inculcate creativity and innovation. Apart from conventional lab, the curriculum provides a freedom for students to perform industry assignments, pilot projects, and innovative self-development by patenting their creativity.

5. Inculcating Ethics and Values:

To improvise student's behavior, the curriculum has included systematic courses on ethics and values. The moral principles can help students to make right decisions, lead their professional lives and become ethical citizen.

6. Blend of Curricular and No curricular Activities

The curriculum also gives importance of different activities like co-curricular, extra-curricular, sports, culture, etc. This will help to do all round development of students in all possible ways.

7. Flexibility

The curriculum provides flexibility by offering various courses/electives in choosing mentorship to work in specialized field in the curriculum as, Capstone Projects, Entrepreneurship, pursuing Research and higher studies and industry internships.

8. Global Competence:

The curriculum provides a unique opportunity for students to learn and engage in open and effective interaction with people from diverse and interconnected world. The provision of international internships in the curriculum helps the students to build a capacity to examine global and intercultural issues and to propose perspectives and views.

9. Industry Induced Internship Program

To support ever demanding industry requirements, the curriculum has included an industry internship with an objective to learn technologies pertaining to their discipline and enhance their technical knowledge with a support of the live platform of Industry.

10. Motivation for Self-Learning:

The curriculum also offers a freedom to students to take the initiatives in their learning needs and set the goals with the help of online learning platforms like MOOCs, NPTEL, Swayam, etc.



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F. Y. M. Tech (Civil Structural Engineering)
Academic Year – 2024-2025 Semester -I

Course Code	Course	Teaching Scheme			Examination Schemes					Credits
		L	T	p	Theory			TW	Total	
					ISE (20)	MSE (30)	ESE (50)			
ES5201T	Numerical Methods in Civil Engineering	03	-	-	20	30	50	-	100	03
CE5201T	Theory of Elasticity	03	-	-	20	30	50	-	100	03
CE5202T	Structural Dynamics and Earthquake Engineering	03	-	-	20	30	50		100	03
CE5203T	Elective-I	03	-	-	20	30	50	-	100	03
CE5204T	Elective-II	03	-	-	20	30	50	-	100	03
CE5205L	Lab Practice I	-	-	04	ISCE: 60		40		100	02
CE5206L	Lab Practice II			02	ISCE: 30		20		50	01
CE5207L	Online course/certification	-	-	04	ISCE: 60		40		100	02
	Audit Course	Non-Credit								
Total		15	-	10					750	20

Elective I		Elective II	
Code No.	Title	Code No.	Title
CE5203T-A	Advanced Concrete Technology	CE5204T-A	Ferrocete Technology I
CE5203T-B	Structural Design of Concrete Bridges	CE5204T-B	Advanced Design of Concrete Structures
CE5203T-C	Theory of Plates and Shells	CE5204T-C	Design of Precast Concrete structures
CE5203T-D	Mechanics of Modern Materials	CE5204T-D	Structural Stability

**Audit Course Code	Audit Course Title
EC5209	Technical Paper writing
CE5208	Disaster Management
ME5208	Value Education in Engineering
CS5209	Constitution of India



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F. Y. M. Tech (Civil Engineering)
Academic Year – 2024-2025 Semester -II

Course Code	Course	Teaching Scheme			Examination Schemes					Credits
		TH	Tu t	Lab	Theory			TW	Total	
					ISE (20)	MSE (30)	ESE (50)			
CE5209T	Finite Element Method	03	-	-	20	30	50	-	100	03
CE5210T	Design of Prestressed Concrete structures	03	-	-	20	30	50	-	100	03
CE5211T	Research Methodology + IPR	03	-	-	20	30	50	--	100	03
CE5212T	Elective-III	03	-	-	20	30	50		100	03
CE5213T	Elective-IV	03	-	-	20	30	50	-	100	03
CE5214L	Lab Practice III	-	-	04	ISCE:60		40	-	100	02
CE5215L	Lab Practice IV	-	-	02	ISCE:30		20	-	50	01
CE5216L	Seminar	-	-	04	ISCE:60		40	-	100	02
Total		15	-	10					750	20

Elective III		Elective IV	
Code No.	Title	Code No.	Title
CE5212T-A	Structural Design of Steel Bridges	CE5213T-A	Sub Sea Engineering
CE5212T-B	Plastic Analysis of Steel Structures	CE5213T-B	Biomechanics and Biomaterials
CE5212T-C	Ferrocete Technology II	CE5213T-C	Retrofitting and strengthening of RC Structures
CE5212T-D	Design of Pre-engineered Buildings	CE5213T-D	Advanced Design of Steel Structures



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[ES5201T]: Numerical Methods in Structural Engineering

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Basic concept of differentiation and integration, differential equations, system of linear equations.

Course Objective:

To make the students familiarize with various Numerical methods which will be useful in finding approximate solution of complex Civil Engineering Problems where analytical methods failed. Also identify the difference between analytical and Numerical methods.

Course Outcome:

On completion of the course, student will be able to–

CO1: Understand numerical methods for approximate solution of algebraic and transcendental equations.

CO2: Learn solution of simultaneous linear equation and Eigen value problem using numerical methods.

CO3: Apply finite difference method and curve fitting to experimental data.

CO4: Understand differentiation and integration of complex function in civil engineering problems using numerical techniques.

CO5: Apply Numerical methods to find approximate solution ordinary differential equation occurring in Indeterminate Beams, Columns.

CO6: Apply Numerical methods to find approximate solution partial differential equation occurring in problems of Plate.

Course Contents

UNIT-I	Solution of algebraic and transcendental equations	06 Hours
Bisection method, Newton–Raphson method, Modified Newton–Raphson method, Successive approximation, Muller’s method, Bairstow’s method, Convergence and stability.		
UNIT-II	System of linear equations and Eigen values	06 Hours
Gauss elimination method, Choleski’s factorization method, Jacobi’s method and Gauss–Seidel method. Numerical computation of Eigen values and Eigen vector by Power method, Householder method and Given’s method.		
UNIT-III	Interpolation and Curve fitting	08 Hours
Interpolation: Finite Differences, Newton’s forward and backward interpolation formulae, Lagrange’s method, Newton’s divided difference Interpolation formulae, curve fitting, least square method, curve fitting by straight line, parabola and related curves.		
UNIT-IV	Numerical differentiation and integration	08 Hours
Numerical Differentiation by finite difference method. Numerical integration by Trapezoidal and Simpson’s methods, Gauss Quadrature method, Newton’s–Cotes method.		
UNIT-V	Solution of Ordinary differential equations	08 Hours

Review of Taylor's series, Euler's method, Modified Euler method, Runge–Kutta fourth order method, predictor–corrector method, Adams–Bashforth method. Applications of finite difference approximation of derivative to Indeterminate Beams, Columns.

UNIT-VI

Solution of Partial differential equations

06 Hours

Finite difference analysis, Explicit and Implicit finite difference scheme, Stability of finite difference method, Applications of finite difference analysis applied to boundary value problems, one dimensional diffusion equation, Wave equation, Laplace equation. Applications of finite difference approximation of derivative to problems of Plates

Reference Books:

R1: S. C. Chapra and R. P. Canale, "Numerical Methods for Engineering", TMH Publications.

R2: E. Balgurusamy, "Numerical Methods", TMH Publications.

R3: M.K. Jain, S.R.K. Iyengar, R.K. Jain "Numerical Methods: Problems and Solutions", 2nd Edition, Wiley Eastern.

R4: S. S. Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall of India.

R5: N. Krishna Raju, "Numerical Methods in Civil Engineering", CBS Publications.

R6: C. F. Gerald and O. Patrick, "Applied Numerical Analysis", Wheatley, Pearson Education, Inc..



First Year M. Tech Civil (Structural Engineering)

Academic Year – 2024-2025 Semester - I

[CE5201T]: Theory of Elasticity

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Basics of stress and strain, deflection of body under various load, boundary conditions, shear force and bending moment diagram

Course Objective:

The Objective of this course is to impart knowledge of theory of elasticity to analyse civil engineering problems with parameters such as geometry, material properties and boundary conditions.

Course Outcome:

On completion of the course, student will be able to–

CO1: Analyze stress strain in Cartesian coordinate system and to apply equilibrium and compatibility conditions.

CO2: Comprehend the boundary value problems (2D and 3D) in Cartesian Coordinate System.

CO3: Apply the boundary conditions in Polar Coordinate System.

CO4: Utilize the concept of failure criteria for effect of stress concentration due to circular hole in a stressed plate.

CO5: Apply the state of stress and strains for plates.

CO6: Quantify the practice problems related to rectangular plates.

Course Contents

UNIT-I	Analysis of Stresses and Strain	06 Hours
Concept of stress at a point, stress tensor, stress on inclined plane, and stress components on a Rectangular parallel piped in Cartesian coordinate system, derivation of stress equilibrium equations, transformation of stresses, stress invariants. The state of strain at a point, strain displacement relations, strain compatibility condition and stress compatibility conditions. Hands on Self-pressure test, Drawing Sketches, Demonstrations.		
UNIT-II	Analysis of Stresses and Strain	06 Hours
Relations between Elastic Constants, Problems on Navier-Lame's Equilibrium Equations, Problems on Beltrami-Michell compatibility equations, Boundary value problems in Elasticity. Generalized Hook's law for Isotropic, Orthotropic, plane stress, plane strain and axisymmetric problems, Problems in 2D and 3D Cartesian coordinate system, Airy's stress function, bending of beams. Hands on Drawing Sketches, Discussion based on technical video / documentaries, Failure case studies, Mini experiments.		
UNIT-III	Polar Coordinate System	08 Hours
Relationship between Cartesian and Polar coordinate system, Equilibrium equations, Strain displacement relations, Stress-strain relationship, Strain-displacement relationship for plane stress and plane strain conditions. Hands on Drawing Sketches, Demonstrations, Model making.		
UNIT-IV	Stress Concentration Problems	08 Hours

Stress concentration problems such as stress concentration due to circular hole in stressed plate (Kirsch's Problem), failure criterion- von mises.

Hands on Discussion based on technical video/documentaries, Drawing Sketches, Failure case studies, Mini experiments.

UNIT-V

Plates

08 Hours

Introduction: Thin and thick plates, small and large deflections. Small deflection theory of thin plates: Assumptions, Moment Curvature relations. Stress resultants. Governing differential equation in Cartesian co-ordinates, various boundary conditions. Pure bending of Plates.

Hands on Discussion based on technical video / documentaries, Drawing Sketches, Application Case studies.

UNIT-VI

Analysis of Rectangular Plate

06 Hours

Analysis of Rectangular Plates: Navier solution for plates with all edges simply supported.

Hands on Discussion based on technical video / documentaries, Application Case studies, Mini experiments

Reference Books:

R1: Timoshenko and Goodier, "Theory of Elasticity", McGraw-Hill Publications.

R2: C. Wang, "Applied Elasticity", Dover Publications.

R3: Enrico Volterra and J. H. Gaines, "Advanced Strength of Materials", Prentice Hall.

R4: S. M. Akazimi, "Solid Mechanics", Tata McGraw-Hill Publications.



First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5202T]: Structural Dynamics and Earthquake Engineering

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Basics structural analysis, basics of mathematics, matrix method of analysis.		
Course Objective: The Objective of this course is to realize the seismic hazards and identify structural dynamic methods for safety and stability of civil engineering structures.		
Course Outcome: On completion of the course, student will be able to– CO1: Analyze degrees of freedom and analyse forced & free vibrations. CO2: Identify the clauses from I.S. 1893, and distinguish between E.S.L. method & R.S. method. CO3: Utilize the T.H. method apply capacity-based design method w.r.to 13920. CO4: Assess the harmonic excitations and apply Duhamel's integral. CO5: Apply forced vibration & free vibration to multistorey building. CO6: Execute nonlinear analysis & interpret the results.		
Course Contents		
UNIT-I	Basics of structural Dynamics	06 Hours
Degrees of freedom & mathematical modelling of dynamic systems. SDOF An undamped& damped free vibration, viscosity & coulomb's damping.		
UNIT-II	Seismic analysis Methods	06 Hours
Design of multi-storey RC Structure with I.S. 1893, by equivalent static lateral load method& R.S. method		
UNIT-III	Shear wall and Ductile detailing	08 Hours
Introduction to time history method, capacity-based design of soft story RC Buildings, Design of shear wall, Ductile detailing as per I.S. 13920		
UNIT-IV	SDOF System	08 Hours
SDOF System: Undamped & damped forced vibrations to harmonic excitations. Response to unit impulse and arbitrary loading by Duhamel's integral and analyses for Nonlinear analysis.		
UNIT-V	MDOF System	08 Hours
MDOF System: Forced vibrations and free vibrations of shear building orthogonally of mode shapes & concept & T.M.D.		
UNIT-VI	Non-Linear Analysis	06 Hours
Non-Linear Analysis, free vibration of cantilever beam by Rayleigh Ritz method.		
Reference Books: R1: S.N. Poulter "Dynamics of structures", Wiley India R2: M. Paz, "Structural Dynamics Theory and Computation", CBS Publications		

R3: A. K. Chopra, “Dynamics of Structures Theory and Applications to Earthquake Engineering”, Prentice-Hall Publications

R4: R.W. Clough and J. Penzin, “Dynamics of Structures”, McGraw Hill Publications

R5: R.C. Roy, “Structural Dynamics an Introduction to Computer Methods”, John Wiley & Sons Publications.

R6: P. Agarwal and M. Shrikhande, “Earthquake Resistant Design of Structures”, Prentice Hall Publications.

R7: Hosure, “Earthquake resistant design of building structures building”, Wiley India.

R8: IS 13920, “Indian Standard Criteria for Ductile Detailing of RC Structure”, Bureau of Indian Standards, New Delhi.

R9: IS: 1893, “Indian Standard Criteria for Earthquake Resistant Design of Structures”, Bureau of Indian Standards, New Delhi.

R10: IS: 13935, “Repair and Seismic Strengthening of Buildings”, Guidelines, 1993.

R11: IS: 4326, “Earthquake Resistant Design and Construction of Buildings” Code of practices.



First Year M. Tech Civil (Structural Engineering)

Academic Year – 2024-2025 Semester - I

[CE5203T-A]: Advanced Concrete Technology

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Behaviour of reinforced concrete structure, limit state method, working stress method, design of basic reinforced concrete structural elements.

Course Objective:

To apply advanced design concept to special structures, ESR, Bunkers, Silos, raft foundation and utilize the knowledge of analysis and design of these different concrete structures in practical life.

Course Outcome:

On completion of the course, student will be able to–

CO1: Produce and test Fibre reinforced concrete, Ferro cement, silica fume & polymer concrete.

CO2: Understand the various properties of special concrete.

CO3: Understand the Mix design by different methods.

CO4: Know the different procedures for testing concrete.

CO5: Understand the concept of durability and cracking in concrete.

Course Contents

UNIT-I	Concrete Composites	06 Hours
Fiber Reinforced Concrete - Introduction, properties of constituent materials, Mix proportion, mixing, casting methods, properties of freshly mixed concrete (Fiber reinforced concrete), workability tests, mechanical properties, Behavior of Fiber reinforced concrete under Compression, tensile, flexure, research findings, application of Fiber Reinforced Concrete Ferro cement - Introduction, materials used, mechanical properties, construction techniques, and design in direct tension, applications, and merits as structural materials. Silica Fume Concrete - Introduction, physical and chemical properties of silica Fume, reaction mechanism of silica fume, properties of silica fume concrete in fresh state, mechanical properties and durability of silica fume concrete. Polymer concrete - Introduction, classification, properties of constituent materials, polymer impregnated concrete, polymer concrete, application.		
UNIT-II	Special concrete	06 Hours
Special Concrete: Light weight concrete, ultra-light weight concrete, vacuum concrete, mass concrete, waste material-based concrete, sulphur concrete and sulphur infiltrated concrete, gap graded concrete, no fines concrete, high strength concrete, high performance concrete.		
UNIT-III	Concrete Mix Design	08 Hours
Design of high strength concrete mixes, design of light weight aggregate concrete mixes, design of fly-ash cement concrete mixes, design of high-density concrete mixes.		
UNIT-IV	Testing of Concrete	08 Hours

a) Tests to Verify Admixture Requirements.

b) Advanced non-destructive testing methods: ground penetration radar, probe penetration, pull out test, break off maturity method, stress wave propagation method, electrical/ magnetic methods, nuclear methods and infrared thermography, core test.

UNIT-V	Durability of Concrete	08 Hours
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Durability of Concrete: Durability, Transport mechanism of fluids and gases in concrete, cracking in concrete – corrosion and carbonation induced cracking, Alkali Aggregate Reaction, degradation by freeze and thaw, chloride attack, sulphate and sea water attack (marine conditions).

UNIT-VI	Advanced Materials for Concrete Protection	06 Hours
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Corrosion Inhibitor, Coating of Steel Reinforcement by Epoxy, Galvanized Steel Bars, Stainless Steel, Fiber Reinforcement Bars, Cathodic Protection by Surface Painting

Reference Books:

R1: M.S. Shetty, “Concrete Technology”, S. Chand Publications.

R2: A R Santhakumar, “Concrete Technology” Oxford University Press.

R3: M. L. Gambhir, “Concrete technology”, Tata McGraw Hill Publications.

R4: P.N. Balguru and P.N. Shah, “Fiber Reinforced Cement Composite”, Mc Graw Hill, New York

R5: P. Kumar Mehta and P. S. M. Monteiro, “Concrete: Microstructure, Properties and Materials”, Tata Mc-Graw Hill Education Pvt. Ltd.

R6: N V Nayak and A. K. Jain, “Handbook on Advanced concrete Technology”, Narosa Publishing House.

R7: A. M. Neville, “Properties of concrete”, Longman Publishers.

R8: R.S. Varshney, “Concrete Technology”, Oxford and IBH.

R9: Dr. D.B. Divekar, “Ferrocement Construction Manual-1030”.

R10: A. P. Remideos, “Concrete Mix Design”, Himalaya Publishing House ISBN-978-81-8318-996-5.

R11: Short & Kenniburg, “Light Weight Concrete”, Asia Publishing House, Bombay

R12: IS: 456:2000, “Indian Standard Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi.

R13: IS:383: 2019 “Indian Standard Code of Practice for Coarse and Fine Aggregate for Concrete - Specification”, Bureau of Indian Standards, New Delhi.

R14: IS: 10262:2009, “Indian Standard Code of Practice for Concrete Mix Proportioning”, Bureau of Indian Standards, New Delhi.

R15: IS: 9103:2020, “Indian Standard Code of Practice for Specification for Concrete Admixtures”, Bureau of Indian Standards, New Delhi.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5203T-B]: Structural Design of Concrete Bridges

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: IRC provisions, loading standards, IS Codes, Different Loadings, Types of Bearings and Expansion Joints, Pier, Abutment, Wing walls, Importance of Soil-Structure Interaction; Types of foundations.		
Course Objective: To design concrete bridge components and provide cost-effective solutions for bridge construction.		
Course Outcome: On completion of the course, student will be able to– CO1: Analyse, design and detailing of orthotopically reinforced slab. CO2: Analysis of load distribution on deck slabs using different methods. CO3: Design of T-beam deck slab bridge and different types of girders. CO4: Analysis and design of rigid frame bridges. CO5: Design of abutments and piers CO6: Analysis and design of various types of bearings		
Course Contents		
UNIT-I	Introduction	06 Hours
Classification of concrete bridges, components of bridge and related structures, economic spans. Factors affecting the selection of site, hydrological data, waterway, scour depth. IRC provisions, loading standards.		
UNIT-II	Analysis of Deck Slab	06 Hours
Load distribution on deck slabs, isotropic plate, grillage analysis, distribution of loads to longitudinal girders, Little-Morrice-Rowe method, Courbon's method, Guy on Massenet method and Hendry Jaegar method, Design of slab and box culverts for highway loadings.		
UNIT-III	Design of Deck Slab & Girders	06 Hours
Design of T-beam deck slab bridge: design of RC deck slab, design of post-tensioned longitudinal girder and cross girders.		
UNIT-IV	Design of Rigid Frame Bridges	06 Hours
Analysis and design of rigid frame bridges		
UNIT-V	Design of Abutments & Piers	06 Hours
Types of abutments, piers, loads acting on pier and abutments, design of abutments, piers		
UNIT-VI	Design of Bearings	06 Hours
Functions of bearings, types, design of elastomeric bearings, design of PTFE-pot bearings.		
Reference Books:		

R1: N.Rajagopalan, "Bridge Superstructure", Alpha Science International, Technology & Engineering 2006.

R2: D.J. Victor, "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

R3: N. Krishna Raju. "Design of Bridges", fourth edition Oxford & IBM Publishing Co, Bombay, 2009.

R4: V.K. Raina, "Concrete Bridge Practice", Tata McGraw Hill Publishing Co., New Delhi 1991

R5: F.W Taylor, S.E. Thomson and E. Smulski, "Reinforced Concrete Bridges", John Wiley & Sons, New York 1955.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - II
[CE5203T-C]: Theory of Plates and Shells

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total :100 Marks
Course Prerequisites: Basic concepts of stress – strain relationship for plates. Basic knowledge for analysis of beams and arches, also basic points differential equation		
Course Objective: The objective of this course is to give proper knowledge to explain classifications of plate and shell structures and describe different analysis theories for various types of plates and shells.		
Course Outcome: On completion of the course, student will be able to– CO1: Classify and describe small deflection theories for thin and thick plates. CO2: Explain and apply the shear and moment deformation theories for rectangular plates designed for various loading and boundary conditions. CO3: Analyze circular plates with various loading and boundary conditions. CO4: Understand shell geometry and analysis theories for thin shells. CO5: Use membrane theory for analysis of circular cylindrical shells. CO6: Analyze the cylindrical roof shells.		
Course Contents		
UNIT-I	Introduction	06 Hours
Introduction: Thin and thick plates, small and large deflections, small deflection theory of thin plates: assumptions, moment curvature relations, stress resultants, governing differential equation in Cartesian co-ordinates, various boundary conditions, pure bending of plates. Analysis of rectangular plates: Navier solution for plates with all edges simply supported, distributed loads, point loads and rectangular patch load		
UNIT-II	Methods of analysis	06 Hours
Levy's Method: Distributed load and line load, plates under distributed edge moments. Raleigh- Ritz approach for simple cases in rectangular plates. Introduction to shear deformation theories, Reissener - Mindlin's theory, moment curvature relationship for First order shear deformation theory.		
UNIT-III	Circular Plates	08 Hours
Circular Plates: Analysis of circular plates under Axi-symmetric loading, moment curvature relations, governing differential equation in polar co-ordinates. Simply supported and fixed edges, distributed load, ring load, a plate with a central hole.		
UNIT-IV	Introduction of shells	08 Hours
Introduction: Classification of shells on geometry, thin shell theory, equations to shell surfaces, stress resultants, stress- displacement relations, compatibility and equilibrium equations. Shells of revolution:		

Membrane theory, equilibrium equations, strain displacement relations, boundary conditions, cylindrical, conical and spherical shells.

UNIT-V

Analysis of Circular cylindrical shells

08 Hours

Circular cylindrical shells: Membrane theory: Equilibrium equations, strain displacement relations, boundary conditions. Bending Theory: Equilibrium equation, strain displacement relations, governing differential equation, solution for a simply supported cylindrical shell, various boundary conditions and application to pipes and pressure vessels.

UNIT-VI

Beam theory

06 Hours

Beam theory of cylindrical shells: Principles of Lundgren's beam theory, beam analysis, arch analysis, and application to cylindrical roof shells.

Reference Books:

R1: S. Timoshenko and W. Krieger, "Theory of Plates and Shells", McGraw Hill.

R2: A. C. Ugural, "Stresses in Plates and Shells", McGrawHill

R3: G. S Ramaswamy, "Design and Construction of Concrete Shell Roofs", CBS Publications.

R4: K. Chandrasekhara "Analysis of Concrete Shells", New Age International Edition.

R5: K. Chandrasekhara "Analysis of Plates", New Age International.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5203T-D]: Mechanics of Modern Materials

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Types of conventional material, elastic properties of materials.		
Course Objective: To have an overview of Material Science and Engineering as a basis for understanding how structure/property/processing relationships are developed and used for different types of materials. Illustrates the role of materials in modern society of advances in new materials and processes to apply them for the advanced manufacturing processing for various structural engineering applications.		
Course Outcome: On completion of the course, student will be able to– CO1: Explain classification and applications of modern materials. CO2: Understand the engineering properties of modern materials CO3: Determine the failure theories. CO4: Identify the behaviour of Composite Laminates. CO5: Analyze and design of Composite Structures. CO6: Experimental analysis of various modern materials.		
Course Contents		
UNIT-I	Introduction to Modern Materials	06 Hours
Fiber-Reinforced Polymer Composite (FRPC) Materials: definition, historical development, applications. Fibers and Matrix: types and their properties, manufacturing process and methods for composites. Types and classification of composite materials, properties, advantages over conventional materials. Piezoelectric Materials: History, crystal structure, applications. Shape Memory Alloys (SMA), Functionally Graded Materials (FGM): definition and applications.		
UNIT-II	Engineering Properties of Modern Materials	06 Hours
FRPC Composite Lamina: Micromechanics approach, methods. Longitudinal and transverse elastic properties of composite lamina, in- plane shear modulus for continuous fibres. Stress-strain relationship, compliance and stiffness matrices for generally anisotropic, especially orthotropic material, transversely isotropic material, orthotropic, isotropic materials, Plane stress condition for thin lamina, transformation of stress and elastic properties. Three dimensional transformations. Stiffness matrix for Functionally Graded Materials.		
UNIT-III	Strength of Composite Lamina	08 Hours
Introduction. Failure theories, Maximum stress theory, Maximum strain theory, Energy based interaction theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu), Failure mode-based theory (Hasin-Rotem). Computation of lamina strength by Tsai-Wu theory for plane stress condition. Comparison of various failure theories.		
UNIT-IV	Elastic behaviour of Composite Laminate	08 Hours

Basic assumptions, Laminate configurations, Strain-displacement relationship, Stress-strain relationship, Force and moment resultants, Laminate Compliances and stiffness matrices, Transformation of matrices. Load deformation relationship for symmetric laminates, symmetric cross-ply, symmetric angle-ply, balanced, anti-symmetric cross-ply and angle ply, orthotropic, quasi-isotropic laminates.

UNIT-V	Design of Composite Structures	08 Hours
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Coefficients of thermal and moisture expansion of various unidirectional lamina, load deformation relationship, residual stresses for cross ply symmetric laminates. Design methodology, design of pressure vessel for various laminate configurations.

UNIT-VI	Experimental Methods of Testing of Composite Materials	06 Hours
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Characterization of constituent materials, fibre, matrix, thermal fibre, interface/interphase characterization, Fibre volume ratio, void volume ratio. Determination of hydrothermal expansion coefficients, tensile, compressive and shear properties of unidirectional laminates. Testing of inter laminar fracture toughness, Biaxial testing, Introduction to stress concentration in laminates.

Reference Books:

R1: I. M. Daniel and O. Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press, Second Edition, New Delhi.

R2: M. W. Hyer, “Stress Analysis of Fiber-Reinforced Composite Materials”, WCB/McGraw-Hill, Singapore.

R3: R. M. Jones, “Mechanics of Composite Materials”, McGraw-Hill, New York.

R4: R. F. Gibbson, “Mechanics of Fiber Reinforced composites”. McGraw-Hill.



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2024-2025 Semester - I

[CE5204T-A]: Ferrocement Technology I

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Basic properties of concrete ingredients, Analysis methods for structural members.		
Course Objective: To have an overview of Ferrocement material as structural smart material for innovative constructions and infrastructural developments.		
Course Outcome: On completion of the course, students will be able to– CO1: Comprehend different types of Ferrocement concrete, its typical properties and proportion of mortar CO2: Recognize the mechanical properties and different construction method using ferrocement. CO3: Design of structure based on form, shape, various structural forms and their behaviour. CO4: Design the houses with cavity walls, hollow floors and hollow beams. CO5: Apply the concept of ferrocement to various structural members. CO6: Apply ferrocement in different space structures and precast products like shells, pyramids, domes etc		
Course Contents		
UNIT-I	Introduction of concrete in structure	06 Hours
Definition. Basic concept like bond increase. Comparison with concretes like RCC, Prestressed, Asbestos cement, Fiber reinforced, Polymer concretes. Composition of ferrocement. Special types of ferrocement. Ferrocement as substitute for conventional building materials. Typical characteristics and their applications. Raw materials, skills, tools and plants. Ferrocement as material of construction. Forming a ferrocement structure. Properties and specifications of raw materials. Proportioning of cement mortar. Job requirements of required skills. Tools and plants		
UNIT-II	Ferro cementing Method	06 Hours
Mechanical properties and typical features affecting design. Properties under static and dynamic loading. Shrinkage and creep. Testing of ferrocement. Experimenting the methods of constructing ferrocement structures. Standardizing method of construction. Planning the work. Fabricating skeleton, tying meshes and mortaring. Curing. Maintenance. Protective surface treatments. Damage to ferrocement structures.		
UNIT-III	Design methods for various Structure	08 Hours
Strength through shape. Design of structure based on form and shape. Forms in nature. Various structural forms and their behaviour. Typical strengths of different materials. Comparative study of various forms. Design of ferrocement structures. Design, analysis and optimization. Special design considerations for ferrocement. Typical features of ferrocement affecting design. Conventional design methods like		

working stress, load factor, applied to ferrocement. Design based on equivalent area method for compression, tension and flexural members. Specific surface method and crack control method, Design of structures subjected to membrane stresses. Design of shaped structures in ferrocement like stiffened plates, arch faced walls, stiffened cavity walls and hollow floors and beams. Design of forms like 'T', 'U' 'T' '+' 'L'.

UNIT-IV	Cost Analysis	08 Hours
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Cost analysis: Factors governing cost analysis. Special considerations for ferrocement structures. Cost comparison with conventional construction. Specifications for ferrocement structures. Quantity analysis of material and labour for ferrocement items. Cost and value of ferrocement construction. Ferrocement in building construction. Ferrocement in foundations, walls, floors roofs. Ferrocement single wall construction. Design and construction of houses with cavity walls, hollow floors and hollow beams. Staircases and other building accessories. Earthquake resisting structures. Special characteristics of ferrocement to resist shock loading. Design and construction of quake proof structures

UNIT-V	Water and Soil retaining structure	08 Hours
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Hydraulic structures. Why ferrocement? Water retaining structures. Storage tanks of various types. Structures across streams. Ferrocement in layered form used for lining, water proofing and surface coating.

Soil retaining structures. Types of retaining walls and their comparison with ferrocement arch faced wall. Design and method of fabrication and casting. ferrocement counter fort retaining wall. Ferrocement containers for storing granular materials.

UNIT-VI	Precast ferrocement products	06 Hours
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Ferrocement large size special purpose structures. Space structures like shells, pyramids, domes corrugated catenaries. Precast ferrocement products: Why ferrocement for precasting? Methods of precasting. Design of precast elements. Ferrocement precast walling and flooring panels. Joints in precast ferrocement elements.

Reference Books:

R1: B. N.Divekar, "Ferrocement Technology- A Construction Manual".

R2: S. P. Shah and P. N.Balaguru "Concrete Technology and Design Vol. II".

R3: Proceedings of International Symposiums on 'Ferrocement and thin reinforced composites. - Ferro 1 to Ferro 10. International Ferrocement Information Centre, A I T Bangkok, Thailand.

R4: "Construction and Repairs of Ferrocement", ACI committee Report. No ACI549R- 88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA

R5: B. R. Paul and R. P.Pama, "Ferrocement Authors", International Ferrocement Information Centre. A.I.T.Bangkok, Thailand.

R6: A. E.Naaman, "Ferrocement and Laminated Cementitious Composite", Techno-press, Ann Arbor, Michigan, U S A.

R7: "Ferrocement- Materials and applications", SP 61, A C I Detroit. U S A.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester -I
[CE5204T-B]: Advanced Design of Concrete Structures

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Behaviour of reinforced concrete structure, limit state method, working stress method, design of basic reinforced concrete structural elements.		
Course Objective: To apply advanced design concept to special structures, ESR, Bunkers, Silos, raft foundation and utilize the knowledge of analysis and design of these different concrete structures in practical life.		
Course Outcome: On completion of the course, student will be able to– CO1: Analyse, design and detailing of orthotopically reinforced slab. CO2: Analyse and design of grid and coffered dam. CO3: Analyse and design of flat slab. CO4: Analyse, design and detailing of elevated service reservoir. CO5: Analyse, design and detailing bunkers and Silos CO6: Analyse, design and detailing Raft and Pile foundation.		
Course Contents		
UNIT-I	Introduction to yield line theory	06 Hours
Yield line theory for analysis of slabs, various patterns of yield lines, assumptions in yield line theory, characteristics of yield lines, equilibrium and virtual work method of analysis. Design of various slabs such as rectangular, triangular, circular with various edge conditions using yield line theory, Design for limit state of strength and serviceability of orthotopically reinforced slabs.		
UNIT-II	Design of grid slab	06 Hours
Grid and coffered slabs, general features, rigorous and approximate method of analysis, design of grid floor by approximate method.		
UNIT-III	Design of flat slab	08 Hours
Flat slabs, types, design methods, column and middle strip, proportioning of flat slab element, total design moment, distribution of moments, effect of pattern loading, design for shear, design of intermediate and end panel by direct methodology		
UNIT-IV	Elevated service reservoir	08 Hours
Elevated service reservoir: Rectangular and circular type only flat bottom, Design of staging for wind and earthquake forces.		
UNIT-V	Miscellaneous structures	08 Hours

Design of bunkers, and Silos, square and circular bunkers, silos shallow and deep beams.

UNIT-VI

Design of foundation and formwork

06 Hours

Design of raft foundations, pile foundations, single pile, group of piles, Pile cap, design of form work for slabs, girders and columns.

Reference Books:

R1: H. J. Shah, “Reinforced Concrete design”, Charotar publishing house.

R2: B. C. Punmia, A. K. Jain and Arun K. Jain, “Reinforced Concrete Structures Vol. II”, Laxmi Publications, New Delhi.

R3: N. C. Sinha, S.K. Roy, “Fundamentals of Reinforced Concrete”, S. Chand & Co. Ltd, New Delhi.

R4: S. S. Bhavikatti, “Advance R. C. C. Design”, New Age International Publishers.

R5: S. Ramaamruthum, “Design of RCC Structures” Dhanpat Rai publications.

R6: P. C. Varghese, “Advanced Reinforced Concrete Design”, Prentice Hall of India Pvt. Ltd., New Delhi.

R7: IS: 456-2000, “Indian Standard Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi.

R8: IS: 1893, “Indian Standard Code of practice for criteria for Earthquake resistant design of Structures”, Bureau of Indian Standards, New Delhi.

R9: IS: 3370, “Indian Standard Code of Practice for Concrete Structures for Storage of Liquids”, Bureau of Indian Standards, New Delhi.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5204T-C]: Advanced Design of Precast Concrete Structures

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Properties of hardened concrete, High performance concrete, Concrete Technology, stress strain.		
Course Objective: The Objective of this course is to enable students to design composite and precast components.		
Course Outcome: On completion of the course, student will be able to– CO1: Identify the materials and precast components. CO2: Apply concept of Ferrocement to precast concrete structures CO3: Design different types of precast components - floor slabs, walls, beams and columns CO4: Analyze and Design of Ferrocement Structures CO5: Apply the optimized method for strengthening of joints of precast structures. CO6: Apply Ferrocement technology to structures based on the concept of strength through shape.		
Course Contents		
UNIT-I	Introduction	06 Hours
History and Development of Precast concrete construction, Advantages and disadvantages of precast concrete construction; different types of units involved in general building construction, including residential, factory and industrial framed structure; their general principles of design; mechanical handling of large projects like stadium, bridges etc. Materials viz. Concrete, Self-Compacting Concrete, Grout, Reinforcement and structural welded wire cages. Requirements of industrialized buildings, standardization of precast elements and unification of building design. Influence of manufacture, transport and erection technologies on design solution (Modular and Tilt-Up); expansion and contraction joints.		
UNIT-II	Ferrocement	06 Hours
Definition, basic concept like bond increase, comparison with concretes like RCC, Prestressed, Asbestos cement, Fiber reinforced, Polymer concretes. Composition of ferrocement, special types of ferrocement. Ferrocement as substitute for conventional building materials, typical characteristics and their applications. Raw materials, skills, tools and plants. Ferrocement as material of construction. Forming ferrocement structure. Properties and specifications of raw materials. Proportioning of cement mortar. Job requirements of required skills. Tools and plants.		
UNIT-III	Prefabricated Components and its Behaviour	08 Hours
Design of precast concrete components and behaviour of structural components, large panel constructions, Construction of roof and floor slabs, Wall panels, Beams, Columns, Shear walls.		

Design for Flexure: Strength design (Depth of Stress block, Flanged Elements, Strength reduction factor, Limitations on reinforcement, Critical sections), Service load design. Design for Shear: Horizontal and vertical shear resistance.

UNIT-IV	Design of Ferrocete Structures	08 Hours
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Design, analysis and optimization, Special design considerations, Typical features of Ferrocete affecting design, Design criteria, Rational method of design ferrocete structure. Strength through shape, Shape and form of a structure, various structural forms and their behaviour, Comparative study of various forms Hydraulic structures, Water retaining structures, Storage tanks of various types. Structures across streams. Ferrocement in layered form used for lining, water proofing and surface coating.

UNIT-V	Joints and Connections	08 Hours
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Joints and connections in precast construction; classification and their requirements. Design of concrete bracket and corbels, cantilever beam design method, Strut-and-tie method.

Introduction to Hanger Connections. Design of bearing pads, column bases and moment connections. Typical connection designs for lateral load resisting systems

UNIT-VI	Space structures and precast products	06 Hours
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Ferrocement large size special purpose structures. Space structures like shells, pyramids, domes corrugated catenaries.

Precast ferrocement products: Why ferrocement for recasting Methods of precasting. Design of precast elements. Ferrocement precast walling and flooring panels. Joints in precast ferrocement elements.

Reference Books:

R1: A. E.Naaman, “Ferrocement and laminated cementations composites”, Techno-press AnnArbor, Michigan, U SA.

R2: “PCI Design Handbook, Precast and Prestressed Concrete”, (6thEdition).

R3: Koncz T. “Manual of precast concrete construction, Vols. I, II and III”, Bauverlag,GMBH.

R4: D. B.Divekar, “Ferrocement Construction Manual”.

R5: “CBRI, Building materials and components”, India, 1990.

R6: “Design,Construction and Repairs of Ferrocement”, ACI549R- 88 and ACI 549.1R.88. American Concrete Institute, Detroit, USA

R7: B.R.Paul and R. P.Pama,“Ferrocement”International Ferrocement Information Centre. A.I.T.Bangkok,Thailand.

R8: “Ferrocement-Materials and applications”, SP 61, A C I Detroit. U S

R9: Ferrocement code -ACI549.1R

R10: C. Z.Gerostiza, C.Hendrikson and D.R.Rehat, “Knowledge Based Process Planning for Construction and Manufacturing”, Academic Press Inc., 1994

R11: “Structural design manual, Precast concrete connection details”, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 1978.



First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5204T-D]: Structural Stability

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Types of conventional material, elastic properties of materials.

Course Objective:

It is a course based on fundamental mechanics that is designed to give the theoretical background to the more practical design-based module

Course Outcome:

On completion of the course, student will be able to–

CO1: Understand the concept of stability for structures

CO2: Apply finite element approach for stability analysis

CO3: Apply differential equation to beam-column joints

CO4: Comprehend buckling loads for optimization of stability

CO5: Apply Energy methods for thin plate problems and beam-column members

Course Contents

UNIT-I	Introduction to structural analysis and significance of stability	06 Hours
Fundamental concepts, elastic structural stability, structural instability, analytical methods for the stability analysis, equilibrium, imperfections and energy methods.		
UNIT-II	Elastic Energy Method	06 Hours
Elastic buckling of columns, assumptions, critical load for various boundary conditions, columns with geometric imperfection, large deflection theory of columns, Southwell plot, Orthogonality of buckling modes, eccentrically loaded columns, numerical techniques – Finite difference and Finite element approach.		
UNIT-III	Buckling of beam-column	08 Hours
Elastic buckling of beam-column, differential equations of beam-column, beam-column with concentrated point load, several point loads, continuous lateral load, single couple, uniformly distributed load, end couples.		
UNIT-IV	Buckling of frames under various loads	08 Hours
Elastic buckling of frames, triangular, partial, multistory portal and box frames with symmetric & anti symmetric buckling, stiffness method approaches, approximate method, buckling of open sections, torsional buckling.		
UNIT-V	Elastic buckling of thin plates	08 Hours
Support conditions of thin plates, equilibrium approach, rectangular plate with axial load in one and two directions, various boundary conditions, Energy methods – Rayleigh Ritz and Galerkin, large deformation theory of plates and effective width concept, post buckling behaviour of plates.		

UNIT-VI	Design methodology for elements	06 Hours
Structural Design for stability of Members, Lateral torsional buckling of beams, lateral torsional buckling of cantilever and S.S. beams, stability design of beam-column member.		
Reference Books: R1: S. P. Timoshenko. and J. M. Gere, “Theory of Elastic Stability”, McGraw Hill,Singapore. R2: G.George, “Introduction to Structural Stability Theory”, McGraw Hill, New York. R3: N. G. Iyengar., “Elastic Stability of Structural elements”, McMillan,India. R4: A. Kumar, “Stability of Structures”, Allied Publishers, New Delhi. R5: M. L. Gambhir,“Stability Analysis and Design of Structures”, Springer-Verlag (2004).		



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5205L]: Lab Practice I

Teaching Scheme: LAB: - 04 Hours/Week	Credit 02	Examination Scheme: ISCE: 60 Marks End Sem. Exam: 40 Marks Total: 100 Marks
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Course Prerequisites:

Concepts of structural static and dynamic analysis.

Course Objective:

Make students to analyze and design the program developed especially for building systems.

Course Outcome:

On completion of the course, student will be able to–

CO1: Create complex building models using objects.

CO2: Assigning the different kind of Load combination (Ultimate & Service) with respect to IS codes.

CO3: Design Structural component of building.

Course Contents

Experiment -I	Modelling in Software
Residential Building and Industrial Building Structural model using software (ETABS / STAADPRO)	
Experiment -II	Analysis of structures using software
Design of RCC frames and multi storied building using software (ETABS / STAADPRO) Steel structure (truss system) using software (ETABS / STAADPRO)	
Experiment -III	Design of Structural Members.
Design structural members using software and interpret the results. (ETABS / STAADPRO)	
Experiment-IV	Programming for design of different structural element
Preparation of program for design of: Slabs, Beams, Columns, Footings.	

References Books:

R1: “National Building Codes”, BIS, New Delhi.

R2: IS 456, IS 800, SP-16, SP-34.

R3: M. A. Jayram & D. S. Rajendra Prasad, “Cad in civil engineering”, Sapna book house,

R4: S. Timoshenko, “Vibration Problems in Engineering”, Van-Nostrand Co, 2009.

R5: T. S. Sarvan, “Staad Pro. V12i for beginners”, 2014.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5206L]: Lab Practice II

Teaching Scheme: LAB: - 02 Hours/Week	Credit 01	Examination Scheme: ISCE: 30 marks End Sem. Exam: 20 marks Total: 50 marks
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Course Prerequisites:

Concepts of structural static and dynamic analysis, finite element analysis.

Course Objective:

To make students to learn principles of Structural Dynamics and apply it to Earthquake Engineering complex problems

Course Outcome:

On completion of the course, student will be able to–

CO1: Examine and evaluate response of structure during Earthquake

CO2: Measure the deformations in a structure and infer from numerical analysis.

CO3: Determine significance of damping

CO4: Virtual demonstration of all Above experiments for critical thinking

CO5: Understanding Detailing of Confine reinforcement on actual site through site visit

Course Contents

Experiment -I	Seismic Response of Structure
Examine and evaluate the response of structure during earthquake using shake table	
Experiment -II	Strains in cantilever beam
. Measure the deformations in a cantilever beam using strain guage and infer from numerical analysis	
Experiment -III	Time Period and Damping
To determine Time Period and Damping of a system using accelerometers and oscilloscope .	
Experiment-IV	Structural Dynamics Virtual Lab
Virtual demonstration of all Above experiments for critical thinking	
Site Visit: Understanding Detailing of Confine reinforcement on actual site through site visit	

Reference Books:

R1: S.N. Paultre “Dynamics of structures”, Wiley India

R2: M. Paz, “Structural Dynamics Theory and Computation”, CBS Publications

R3: A. K. Chopra, “Dynamics of Structures Theory and Applications to Earthquake Engineering”, Prentice-Hall Publications

R4: R.W. Clough and J. Penzin, “Dynamics of Structures”, McGraw Hill Publications.

R5: P. Agarwal and M. Shrikhande, “Earthquake Resistant Design of Structures”, Prentice Hall Publications.

R6: Hosure, “Earthquake resistant design of building structures building”, Wiley India.

R7: IS 13920, “Indian Standard Criteria for Ductile Detailing of RC Structure”, Bureau of Indian Standards, New Delhi.

R8: IS: 1893, “Indian Standard Criteria for Earthquake Resistant Design of Structures”, Bureau of Indian Standards, New Delhi.

R9: IS: 13935, “Repair and Seismic Strengthening of Buildings”, Guidelines, 1993.

R10: IS: 4326, “Earthquake Resistant Design and Construction of Buildings” Code of practices



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2024-2025 Semester - I
[CE5207L]: Online Course/Certification

Teaching Scheme: Lab: 04 Hours/Week	Credit 02	Examination Scheme: ISCE : 60 Marks ESE: 40 Marks Total :100 Marks
Prerequisites Courses: Basics analysis or design concepts of the selected course.		
Course Objective: The Objective of this course is to prepare students to learn the courses using online teaching aids.		
Course Outcome: On completion of the course, student will be able to— CO1: Use modern ICT tools for self-learning. CO2: Demonstrate the ability to abreast with advance technologies. CO3: Apply the analysis/design tools for solving the structural engineering problems.		
Course Contents		
The students should complete at least one NPTEL Certification course which will be offered by NPTEL Courses during the same semester. The students should select the subjects relevant to MTech. (Structural Engineering) and which should not include in the specified curriculum. Minimum duration of course should be 4 weeks and all assignments should be submitted. Certification done would be appreciated but not mandatory. In case a student does not go for certification, he/she should pass the internal test organized by department for the said course.		



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Academic Year – 2024-2025 Semester - I

[]: Audit Course - I**

The purpose of audit courses is to give general awareness about the social issues to the students. Students are expected to apply the scientific way to analyze the data and make use of their technical expertise to deal with the issues. The basic objective is to give a different learning experience in context with social issues. Assessment of the student's work will be done on the basis of assignments/reports/presentations/oral/exam/test.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has at least 75% or above attendance and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

Evaluation Criteria:

Guidelines for Conduction (Any one or more of following but not limited to)

- | | |
|---|---|
| <ul style="list-style-type: none"> Lectures/ Guest Lectures Visits (Social/Field) and reports Demonstrations | <ul style="list-style-type: none"> Surveys Mini Project Hands on experience on |
|---|---|

Guidelines for Assessment (Any one or more of following but not limited to)

- | | |
|---|--|
| <ul style="list-style-type: none"> Written Test Demonstrations/ Practical Test Poster presentation | <ul style="list-style-type: none"> Presentations IPR/Publication Report |
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Audit Course I

**Audit Course Code	Audit Course Title
EC5209	Technical Paper writing
CE5208	Disaster Management
ME5208	Value Education in Engineering
CS5209	Constitution of India



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Academic Year – 2024-2025 Semester - I

[EC5209]: Technical Paper Writing

Course Prerequisites: Nil

Course Outcome:

On completion of the course, student will be able to–

CO1: Write a paper and report.

CO2: Properly present papers in conferences with neat flow.

Course Contents

UNIT-I		06 Hours
Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.		
UNIT-II		06 Hours
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.		
UNIT-III		08 Hours
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.		
UNIT-IV		08 Hours
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.		
UNIT-V		08 Hours
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.		
UNIT-VI		06 Hours
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.		

Reference Books:

R1: Writing for Science, Goldbort R, Yale University Press

R2: How to Write and Publish a Scientific Paper, Day R, Cambridge University Press

R3: Handbook of Writing for the Mathematical Sciences, Highman N, SIAM. Highman's book

R4: English for Writing Research Papers, Adrian Wallwork, Springer New York Dordrecht Heidelberg London.



First Year M. Tech Civil (Structural Engineering)

Academic Year – 2024-2025 Semester - I

[CE5208]: Disaster Management

Course Prerequisites: Nil

Course Objective:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcome:

On completion of the course, student will be able to–

CO1: Respond in critical Disaster Situation.

CO2: Help in affected areas.

Course Contents

UNIT-I	Understanding Disasters	02 Hours
Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.		
UNIT-II	Types, Trends, Causes, Consequences and Control of Disasters	08 Hours
Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.		
UNIT-III	Disaster Management Cycle and Framework	08 Hours
Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.		
UNIT-IV	Disaster Management in India	07 Hours
Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies.		
UNIT-V	Applications of Science and Technology for Disaster Management	07 Hours

Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.

UNIT-VI

Suggested Areas for Project and Assignments

07 Hours

Study of Recent Disasters (at local, state and national level) And Preparation of Disaster Risk Management Plan of an Area or Sector Role of Engineers in Disaster Management.

Reference Books:

R1:Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.

R2:Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi

R3:An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi

R4: World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland.

R5: Encyclopedia of disaster management, Vol I, II and III. Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006.

R6: Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008

R7: Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur

R8: Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages

R9: Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages

R10: Disaster Management Act 2005, Publisher by Govt. of India

R11: Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management.

R12: NIDM Publications.

R13: High Power Committee Report, 2001, J.C. Pant.

R14: Disaster Mitigation in Asia & Pacific, Asian Development Bank.

R15: National Disaster Management Policy, 2009, Govt. of India.

R16: Disaster Preparedness Kit, American Red Cross.



First Year M. Tech Civil (Structural Engineering)

Academic Year – 2024-2025 Semester - I

[ME5208]: Value Education in Engineering

Course Prerequisites: Nil

Course Objective:

1. Understand value of education and self- development.
2. Imbibe good values in students.
3. Let they should know about the importance of character.

Course Outcome:

On completion of the course, student will be able to–

CO1: Knowledge of self-development.

CO2: Learn the importance of Human values.

CO3: Developing the overall personal.

Course Contents

UNIT-I

06 Hours

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

UNIT-II

06 Hours

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

UNIT-III

08 Hours

Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV

08 Hours

Character and Competence –Holy books vs Blind faith. Self-management and good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Reference Books:

R1: Values and Ethics for organizations Theory and practice, Chakraborty, S.K. Oxford University Press, New Delhi

R2: Value Education in Engineering, S Chand Publication.



First Year M. Tech Civil (Structural Engineering)

Academic Year – 2024-2025 Semester - I

[CS5209]: Constitution of India

Course Prerequisites: Nil

Course Objective:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcome:

On completion of the course, student will be able to–

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

Course Contents

UNIT-I	06 Hours
History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) welfare of SC/ST/OBC and women.	
UNIT-II	06 Hours
Philosophy of the Indian Constitution: Preamble, Salient Features.	
UNIT-III	08 Hours
Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties	
UNIT-IV	08 Hours
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.	
UNIT-V	08 Hours
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	
UNIT-VI	06 Hours

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

Reference Books:

R1: The Constitution of India, 1950 (Bare Act), Government Publication.

R2: Dr. B. R. Ambedkar framing of Indian Constitution, Dr. S. N. Busi, 1st Edition

R3: M. P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis

R4: Introduction to the Constitution of India, D.D. Basu, Lexis Nexis



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2024-2025 Semester - II

[CE5209T]: Finite Element Method

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total :100 Marks
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Course Prerequisites:

A basic knowledge of Basic Numerical Methods course which focuses on linear systems and ordinary differential equations would suffice. Basic calculus (Differentiation and Integration), Differential Equations (ODEs/PDEs) Linear Algebra, Solid Mechanics, Tensor algebra and calculus Variational principles would be a added advantage.

Course Objective:

This course will enable students to understand the mathematical and physical principles underlying the FEM. &Improvise them to identify and solve relatively complex engineering problems using commercial FEM software's such as STAAD Pro, ETABS etc.

Course Outcome:

On completion of the course, students will be able to–

CO1: To apply the basic knowledge of elasticity to solve continuum mechanics problems, use numerical technique like Rayleigh –Ritz method, Gelrkins method to solve partial differential equations of structural engineering problems.

CO2: To evaluate various methodologies namely polynomial functions, stiffness matrix and degrees of freedom concepts

CO3: To relate the shape functions and its coordinate system & apply the logic to development for shape functions for 1D 2D 3D element.

CO4: To demonstrate the development of Jacobian matrix and its formulation for various elements like beam, truss etc.

CO5: To apply the various theories of plate bending to four and eight noded isoparametric elements.

CO6: To understand stress strain relations & study the Flat and Curved shell

Course Contents

UNIT-I	Introduction to Finite Element	
Background on variational calculus, Galerkin method, collocation method, least squares methods, Variational methods of approximation, Rayleigh-Ritz method, Variational theorem, principle of minimum potential energy, use of polynomial displacement function, variational approach for formulation of element stiffness matrix for truss and beam elements, Strong and Weak formulation.		
UNIT-II	Basic Methods of Finite Element	06 Hours
Two dimensional elements in plane stress / plane strain problems. CST, LST and rectangular elements, modeling considerations, aspect ratio, use of polynomial displacement functions, Pascal 's triangle. Requirements for convergence, geometric invariance, grid refinement. Standard stiffness and load vector formulation procedures using variational principle. Condensation of internal degrees of freedom-Summary of analysis procedure.		
UNIT-III	Interpolation Methods	08 Hours

Shape functions in Cartesian and natural coordinate systems, shape functions for one, two- and three-dimensional elements. Higher order elements- Lagrange –Serendipity – Interpolation-formulation of element stiffness.

UNIT-IV	Isoperimetric Formulations	08 Hours
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Concept of isoperimetric elements and isoperimetric mapping, Jacobean matrix, formulation of two dimensional quadrilateral isoperimetric elements in plane elasticity problem, 3-D isoperimetric elements.

UNIT-V	Modeling Methods	08 Hours
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Thin Plate bending elements, various triangular and rectangular elements, ACM (Adini, Clough, Melosh) and BFS (Bogner, Fox, Schmidt) elements. Conforming and non- conforming elements, concept of four noded and eight noded isoparametric elements, Mindlins hypothesis for plate bending element.

UNIT-VI	Application of FEM to Formulations	06 Hours
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Axisymmetric elements in axisymmetric problems, stress strain relations, triangular and Quadrilateral elements. Flat and curved shell element, elements for cylindered shells, curved solid elements.

Reference Books:

R1: J. N. Reddy, “An Introduction to the finite element method”, Tata McGraw Hill Publishing Co. Ltd.

R2: C. S. Krishna Moorthy, “Finite Element Analysis: Theory & Programming”, Tata McGraw Hill Publishing Co. Ltd.

R3: G. R. Buchanan, “Finite Element Analysis Schaum’s outlines”, Tata McGraw Hill Publishing Co. Ltd.

R4: D. L. Logan, “A First Course in Finite Element Method”, Cengage Learning.

R5: S. S. Bhavikatti, “Finite Element Analysis”, New Age International Publishers, Delhi.

R6: S. S. Rao, “The Finite Element Method in Engineering” 4th Edition, Elsevier Publication.

R7: O. Zienkiewicz & R. Taylor, “The Finite Element Method” 4th Edition, Vol. I &II, McGraw Hill International Edition.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2023-2024 Semester -I
[CE5210T]: Design of Pre-stressed Concrete Structures

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Behaviour of prestressed concrete, methods of prestressing, loss and stress calculation in prestressed members

Course Objective:

To analyse the behaviour of different prestressed concrete element, enable to detail different prestressed concrete elements and composite sections.

Course Outcome:

On completion of the course, student will be able to–

CO1: Analyze and design of pre tensioned flexural members.

CO2: Analyze and design of post tensioned flexural member.

CO3: Analyze and design of post tensioned slab.

CO4: Design composite sections.

CO5: Analyse and design of statically indeterminate prestressed members like continuous beam and frame.

CO6: Analyze and design of prestressed pipes and circular tanks.

Course Contents

UNIT-I	Pre-tensioned Flexural members	06 Hours
Design of Pre-tensioned Flexural members: Design of pole, sleepers, pipes, cylinders and lintels.		
UNIT-II	Post tensioned Flexural members	06 Hours
Design of Post tensioned Flexural members: Design Tee, I and box section girders.		
UNIT-III	Post tensioned Prestressed Concrete Slabs	08 Hours
Design of Post tensioned Prestressed Concrete Slabs: Introduction, Design of one way, two way and flat slabs.		
UNIT-IV	Composite Beams	08 Hours
Composite Beams: Composite sections of Prestressed concrete beam and cast in-situ RC slab Analysis of stress, Differential shrinkage, Deflections, Flexural and Shear strength of composite sections, Design of composite sections.		
UNIT-V	Statically Indeterminate Structures	08 Hours
Statically Indeterminate Structures: Analysis and Design of continuous beams and Frames including choice of cable profile, linear transformations, concordance of cable and shift calculations.		
UNIT-VI	Prestressed Concrete Pipes and Tanks	06 Hours

Prestressed Concrete Pipes and Tanks: Circular prestressing, types of Prestressed concrete pipes.
Prestressed Concrete tanks: General features, Analysis and design of circular tanks.

Reference Books:

R1: N. Krishna Raju, “Prestressed Concrete”, Tata McGraw Hill PublicationCo.

R2: B. C. Punmia, A. K. Jain and Arun K. Jain, “Reinforced Concrete Structures Vol. II”, Laxmi Publications, New Delhi.

R3: T. Y. Lin & N. H. Burns, “Design of Prestressed Concrete Structures”, JohnWiley.

R4: E. G. Nawy, “Prestressed Concrete- A Fundamental Approach”, Practice Hall International.



First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5211T]: Research Methodology & IPR

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:
Basic Concepts of Statistics

Course Objective:

The objective of the course is to explain the basic of research, process involved; identify appropriate research topics, sampling techniques and data interpretation. It will create consciousness for Intellectual Property Rights and its constituents. Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

Course Outcome:

On completion of the course, student will be able to–

CO1: Demonstrate knowledge of research processes; describe sampling methods, measurement scales and instruments and appropriate uses of each.

CO2: Perform literature reviews using print and online databases and follow research ethics.

CO3: Prepare effective research proposals and reports.

CO4: Identify, apply and assess principles of law relating to each of these areas of intellectual property;

CO5: Demonstrate a capacity to assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing;

CO6: Understand current and emerging issues relating to the intellectual

Course Contents

UNIT-I	Meaning of research problem	06 Hours
Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.		
UNIT-II	Literature review	06 Hours
Effective literature studies approach, analysis Plagiarism and Research ethics.		
UNIT-III	Effective technical writing	08 Hours
How to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.		
UNIT-IV	Nature of Intellectual Property	08 Hours
Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.		
UNIT-V	Patent Rights	08 Hours
Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.		
UNIT-VI	New Developments in IPR	06 Hours

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Reference Books:

R1: Stuart Melville and Wayne Goddard, “Research methodology: An introduction for science & engineering students”, Juta & Co. Ltd, 1996

R2: Ranjit Kumar, “Research Methodology: A Step-by-Step Guide for beginners”, Pearson, 2005

R3: Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.

R4: Mayall, “Industrial Design”, McGraw Hill, 1992.

R5: Niebel, “Product Design”, McGraw Hill, 1974.

R6: Asimov, “Introduction to Design”, Prentice Hall, 1962.

R7: R. P. Merges, P. S. Menell, M. A. Lemley, “Intellectual Property in New Technological Age”, 2016.

R8: T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2023-2024 Semester - II
[CE5212T-A]: Structural Design of Steel Bridges

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Standard specifications, IRC loading, loading standards, gussets, cross frame members, steel plates, lateral bracing, expansion joints and hinges, webs, flanges, stiffeners,		
Course Objective: To design different components and apply in steel bridges and design philosophy of steel bridge to control for heavy traffic.		
Course Outcome: On completion of the course, student will be able to— CO1: Classify different components of bridges and compare with standard specifications. CO2: Analyse, through type and deck type plate girder bridges. CO3: Design plate girder bridges. CO4: Analyse and design truss bridge. CO5: Analyse and design cable supported steel bridges and box girders. CO6: Analyse supporting members of box girders.		
Course Contents		
UNIT-I	Introduction	06 Hours
Introduction to bridge engineering, classification and components of bridges, layout, planning, structural forms of bridge decks, beam and slab decks, cellular decks, standard specification for bridges, IRC loadings for road bridges, loading standards for railway bridges.		
UNIT-II	Analysis of Different Types of Bridges	06 Hours
Analysis and design of beam and plate girder bridges, analysis of through type and deck type bridges		
UNIT-III	Effect of Different Buckling	08 Hours
Design of plate girder bridges, main plate girder, shape limitation based on local buckling, lateral torsional buckling, web buckling, shear moment interaction, fatigue effect, Lateral bracing		
UNIT-IV	Design of Truss Bridges	08 Hours
Design of truss bridges, optimum depth of truss girder, design of compression chord member, design of tension chord member, design of vertical and diagonal member, Lateral bracing		
UNIT-V	Design of Suspension Bridges	08 Hours
Design of cable supported steel bridges, design of steel box girder, design of suspension cables, Suspension bridges.		
UNIT-VI	Design of Different types of Boxes	06 Hours
Box section flexural members, diaphragm requirements at support, bearing, top lateral bracing in tube girder, horizontally curved boxes, single boxes, closed boxes, proportioning limits		
References Books:		

- R1:** G. W Owens, P. R. Knowle, P. J. Dowling, “Steel Designers Manual”, Fifth edition, Blackwell Scientific Publications.
- R2:** S. Chatterjee “The Design of Modern Steel Bridges”, First edition, BSP Professional books.
- R3:** E. T. Demetrios, “Design, Rehabilitation and Maintenance of Modern Highway Bridges”, McGraw-Hill Publishers.
- R4:** D. J. Victor, “Essentials of Bridge Engineering”, Oxford and IBH Publishers.
- R5:** IRC: 6 - 1966 – Section II, “Indian Standard for loads and stresses on Highway Bridges”.
- R6:** Bridge rules - 1982, Specifications for Indian Railway loading.
- R7:** T. R. Jagadeesh and M. A. Jayaram, “Design of Bridge Structures”, Prentice-Hall of India.
- R8:** N. Krishna Raju, “Design of Bridges”, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- R9:** D. J. Lee, “Bridge Bearings and Expansion Joints”, E & FN Spon.
- R10:** V. K. Raina, “Concrete Bridge Practice Analysis, design and Economics”, Tata McGraw Hill.
- R11:** IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83



First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5212T-B]: Plastic Analysis of Steel Structures

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Structural analysis-I, Structural analysis –II

Course Objective:

To understand the concept of plastic analysis of steel frames, to decide reserve strength of structure after attaining first yield point, to determine shape factor of various cross sections and to design the beam/ frame using plastic method of analysis are main objectives of the course.

Course Outcome:

On completion of the course, student will be able to–

CO1: Demonstrate the behaviour of steel structures in plastic state of deformation.

CO2: Determine collapse load of structure by statical and mechanism method.

CO3: Analyze various steel frames using plastic analysis method.

CO4: Assess the importance of plastic analysis and employ the concept for design of steel structures.

CO5: To identify the effect of additional stresses interacting with bending stresses in steel member.

CO6: To employ the design concepts of steel frames with and without haunches along with connections.

Course Contents

UNIT-I	Introduction to plastic analysis	06 Hours
Plasticity in ductile materials, actual and idealized stress-strain graph for mild steel, elasto-plastic behavior of beam in flexure, shape factor for different cross sections, yield zones, concept of plastic hinge.		
UNIT-II	Analysis of beams and frames	06 Hours
Plastic collapse loads of determinate and indeterminate structures such as beams and rectangular portal frames, statical and kinematical methods, basic and combined mechanisms. Determination of plastic collapse loads, bending moment diagram at collapse.		
UNIT-III	Analysis of gable portal frames	08 Hours
Plastic collapse loads of frames with inclined members such as gable portal frames, various mechanisms.		
UNIT-IV	Limit state design of beams	08 Hours
Requirement of steel for design, Limit State of Strength and Serviceability, partial safety factors, design of laterally supported beams, shear resistance		
UNIT-V	Design of beams for combined action	08 Hours
Secondary design considerations, design of beams with high shear, interaction of bending and shear, interaction of bending and axial force.		
UNIT-VI	Design of frames and connections	06 Hours

Design of rectangular and gable portal frames, design of corner connection with and without haunches.

Reference Books:

R1: A. S. Arya and J. L. Ajmani, “Design of Steel Structures”, Nemchand & Bros., Roorkee.

R2: “Teaching Resource for Structural Steel Design”, INSDAG Kolkata.

R3: Ramchandra, “Design of Steel Structures” Vol – II, Standard Book House, Delhi

R4: B. G. Neal, “Plastic Method of Structural Analysis”, Chapman & Hall.

R5: L. S. Beedle, “Plastic Design of Steel Frames”, John Willey & Sons.



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5212T-C]: Ferrocement Technology II

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Basic properties of all materials which are used in concrete and prestressed members for design. Basic knowledge of all IS codes required for RCC, prestressed, water structures space structure, soil and water retaining structures.

Course Objective:

The objective of this course is to give proper knowledge to students about various types of RCC, Prestressed, and water retaining and space structure design. Also, they are able to solve design problems of all structures like RCC, Steel, Composite, Water and soil retaining structures.

Course Outcome:

On completion of the course, student will be able to–

CO1: Identify different types of Ferrocement concrete, its typical properties and rational methods of design.

CO2: Design members in compression, tension, flexure and shear

CO3: Design of structures using Fibrocement.

CO4: Analysis of various forms for stress pattern under loading

CO5: Apply ferrocement techniques in different RCC structures

CO6: Apply ferrocement techniques in different Space structures and precast products

Course Contents

UNIT-I	Design of structure based on Properties	06 Hours
Ferrocement – correct definition, standard method of construction, design for direct field applications, and ferrocement for structural applications, thin layered system changed to solid form. Typical mechanical properties and characteristics, parameter of design, review of present methods of designs based on RCC. Design of ferrocement structure based on its typical properties, like specific surface, crack width control and strength through shapes. Rational methods of design based on Equivalent area, equivalent strain, Specific surface, volume fraction of steel and wire diameter, Crack width control method Ductility and energy absorbed per unit volume.		
UNIT-II	Basic Properties and design based on various theory	06 Hours
Equivalent area and equivalent stress method- “m” value, Moment of Inertia of section, design of compression members, walls, columns, and member subjected to membrane stresses. Equivalent area and equivalent stress method- “m” value, Moment of Inertia of section, design of compression members, walls, columns, and member subjected to membrane stresses. Equivalent stress and the principle of superimposition applied to stress-strain curves for mortar, meshes, and ferrocement composites. Locate stress at first crack and at yield point on curve based on tensile strength of mortar and yield strength of steel wire. Chord modulus of elasticity for design in multiple cracking zones.		
UNIT-III	Design based on crack width	08 Hours

Design based on crack width- Relationship between crack width -its spacing and stress in steel wire.. Equation establish in relationships between crack width, spacing of cracks, modular ratio, modulus of elasticity and tensile stress of mortar. Crack control method of design- applied to pipes, silos, water tanks and waterproofing systems.

Design of ductility -Strain energy absorbed per unit volume of ferrocement. Its use in design of structures subjected to dynamic loading-earthquake, wind, machine foundations.

UNIT-IV	Design of composite structure	08 Hours
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Shaping ferrocement to gain strength, stress pattern changed due to shaping, Different shapes and stress Patterns like flexure to compression, different ways of giving forms, boxing, corrugating, folding, ribbing, stiffening, arching, waffling. Giving shapes in three dimensions. Analysis of various forms for stress pattern under loading- cavity walls, hollow floors, hollow columns and beams, stiffened plates in compression and flexure, built in sections like H, U, T, +, L. Shells of translation and rotation, domes, pyramids, folded plates.

Design of composite structures of ferrocement with RCC, steel and masonry. Precast ferrocement elements with in-built RCC framework. Joints of precast members as structural members their design and construction, Confining and strengthening damaged structures, retrofitting.

UNIT-V	Design of Water and Soil retaining structure	08 Hours
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Applications in building construction: Parabolic foundations, under-reamed piles, Panelled cavity walls and box-sectioned hollow floors, hollow beams. Stiffened plates as slabs. Design and construction of multi-storied buildings and mass scale housing using in-situ mortaring method and method of joining precast walling and floor panels.

Water and soil retaining structures: Applications in water treatment and effluent treatment plants and in Irrigation, Highways and Bridges.

UNIT-VI	Various Precast Products	06 Hours
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Space structures like shells, pyramids, domes, folded plates. Special purpose Structures subjected to shock loadings like wind, earthquake, Tsunami, blast and fire. Acoustic design in ferrocement buildings. Standardizing precast ferrocement products like manholes and their covers, chajja and lintels, water tanks, septic tanks, stiffened plates for walling and flooring panels. Lost forms for RCC columns, beams and slabs. Design and casting of ferrocement spun pipes to replace prestressed concrete pipes. Precast parabolic canal sections.

References:

R1: “State-of-the-art report and guide for Design, Construction and Repairs of Ferrocement”; ACI Committee Report. No ACI549R- 88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA

R2: B. R. Paul and R. P. Pama, “Published by International Ferrocement Information” Centre. A.I.T.Bangkok, Thailand.

R3: A. E. Naaman “Ferrocement and laminated Cementitious composite”, Publisher: Techno-press, Ann Arbor, Michigan, USA.

R4: “Ferrocement- Materials and applications” SP 61, A C I Detroit. USA.

R5: B. N. Divekar, “Ferrocement Technology- A Construction Manual”.



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5212T-D]: Subsea Engineering

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Engineering Mechanics, Structural Analysis, Steel Structures, Composites.		
Course Objective: To acquire knowledge of functions, type & loading on different subsea components and undersea construction for extraction of oil and gas.		
Course Outcome: On completion of the course, student will be able to– CO1: Explain functions of different subsea components, their construction and use. CO2: Understand the fundamentals of flow management of subsea production system. CO3: Illustrate installation of subsea plant. CO4: Enlist and explain inspection methods of risk management. CO5: Understand the applications of different subsea equipment. CO6: Design different special subsea components.		
Course Contents		
UNIT-I	Introduction	06 Hours
Introduction to oil and gas industry: general view of oil and gas industry, technological challenges and future developments. Overview of deep-water developments: introduction, deep water areas and potential, challenges, route for development Metocean and environmental conditions: Overview of the determination of Metocean conditions (meteorological and oceanographic) and the influence of wave, wind, tide and current on marine operations. Introduction to marine ecology and its impact on marine operations.		
UNIT-II	Infrastructure Development	06 Hours
Infrastructure development: Summarize the current state of the art and highlights the design challenges. Outlines the way in which water depth influences the architecture and technology of Oil and Gas infrastructure. Flow assurance: overview of flow assurance and the fundamentals of flow management for subsea production systems, Introduction to flow assurance issues like paraffin deposition; hydrate formation and blockage; Asphaltene precipitation; emulsions; experimental methods, flow assurance assessment methods; prevention, mitigation and remediation tools for flow assurance issues; thermal management and insulation materials.		
UNIT-III	Installation and Intervention	08 Hours
Overview of the installation of subsea plant, risers and pipelines and the main intervention methods including AUVs, ROVs and divers. Subsea operations and control: An overview of the principle methods of subsea control including electrical, acoustic and hydraulic systems. Subsea processing and artificial lift: introduction the analytical and numerical models used to design subsea processing systems for sustained recovery of hydrocarbons.		
UNIT-IV	Reliability And Integrity Management	08 Hours

Introduction to Risk Assessment, FMECA and HAZOPS, Monitoring, Intervention and Inspection Methods, Data Management Construction management of oil field, future challenges.

UNIT-V

Subsea Field Equipment

08 Hours

Structures and architectures: scale of operations, environmental factors, A description of each of the pieces of the subsea infrastructure, their use and interconnection including subsea trees, flow lines, umbilical's, risers, moorings and pipelines Materials and corrosion. Types of corrosion found in the oilfield with emphasis on the effects of acid gases

UNIT-VI

Pipelines and Design

06 Hours

Introduction to pipeline engineering, the main pipeline design challenge in deep water. Analysis and design methods of pipelines that address stress analysis, buckling and collapse of deep-water pipelines. Limit state-based strength design methods. Geotechnical aspects of pipeline design and its installation. Deepwater risers: different design options available for deep water risers, and defines the key design drivers for each. General principles of stress analysis: An introduction to the principles of stress analysis and the principles of reliability based design, finite element analysis.

Reference Books:

R1:Petex, "A Primer of Offshore Operations".

R2:Yong Bai and, Qiang Bai, "Subsea Engineering Handbook Hardcover".

Supplementary Reading:

<https://nptel.ac.in/courses/114/106/114106011/>

Lab Exercises:

- I. Assignment on types of subsea structures.
- II. Assignment on fundamentals of subsea structures and construction, installation.
- III. Assignment on the design of subsea pipeline systems, Numerical, Use of Norsok Codes.
- IV. Assignment on oil well caisson foundations, and superstructure construction.
- V. A case study of typical subsea structure analysis, design, installation.
- VI. Assignment on Use of international standards for subsea system designs.



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester -II

[CE5213T-A]: Pre-Engineered Buildings

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Limit State Design of steel structures.

Course Objective:

To understand fabrication aspects, inculcate analytical and design aptitude and be able to prepare fabrication drawing and detailing of Pre-Engineered Buildings.

Course Outcome:

On completion of the course, student will be able to–

CO1: Understand fabrication aspects of pre-engineered buildings.

CO2: Analyze strategies of pre-engineered steel buildings.

CO3: Understand Code provisions of pre-engineered buildings.

CO4: Design strategies of pre-engineered steel buildings.

CO5: Optimize design to have optimum cost of material.

CO6: Produce fabrication drawings of pre-engineered building components.

Course Contents

UNIT-I	Introduction to pre-engineered buildings	06 Hours
History Concept, Difference between Conventional Steel Buildings and Pre-Engineered buildings, components of pre-engineered buildings, material and connections used for manufacturing of PEB, Advantages of PEB, Applications of PEB, Pre-Engineered Building Components.		
UNIT-II	Analysis of the Pre-Engineered buildings	06 Hours
Plastic analysis, Analysis for wind load, Seismic analysis.		
UNIT-III	Code stipulations	08 Hours
Code provisions: AISC, AISI, MBMA, ANSI, ASCE, UBC and IS codes, Design for stability, flexure, shear and deflections.		
UNIT-IV	Design of components	08 Hours
Design of primary frame, Gable end framing, Secondary framing, Bracing systems.		
UNIT-V	Design optimization	08 Hours
Iterative design procedure to arrive at optimum section sizes.		
UNIT-VI	Fabrication drawings and detailing	06 Hours
Components of fabrication drawings, Fabrication details of various components of the pre-engineered buildings		

Reference Books:

R1: A Newman, “Metal Building Systems Design and Specifications”, McGraw-Hill publication, ISBN 978-0-07-177664-6

R2: N Subramanian, “Design of Steel Structures”, OUP India publication, ISBN 978-0-19- 567681

R3: K. S. Vivek and P. Vaishnavi, “Pre-Engineered Steel Buildings”, Lambert Academic Publishing

Supplementary Reading:

<http://nptel.ac.in/courses/105106113/3>

Lab Exercises:

- I. Analysis and design of one of the frames of Pre-Engineered building.
- II. Fabrication drawings of the frame with connection details.



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5213T-B]: Bio Mechanics and Bio Materials

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
Course Prerequisites: Stress strain Relationship, Material Properties, Composite material properties		
Course Objective: The Objective of this course is to link engineering analogy to biological systems.		
Course Outcome: On completion of the course, student will be able to— CO1: Identify structure of tissue, classification of bio material. CO2: Differentiate biomaterials composition and fabrication method. CO3: To analyze biomaterial composite and its structure. CO4: Inspect and assess Mechanical properties of bone. CO5: To assess joint mechanism and evaluation of joint forces and moments. CO6: Identify the different type biomaterials and their suitability.		
Course Contents		
UNIT-I	Structure of biomaterials and hard tissue	06 Hours
Structure of biomaterials, classification of bio materials, mechanical properties, Hookean elasticity, elasticity of non-Hooke a material. Elasticity models for bio materials. Structure of Hard tissue.		
UNIT-II	Composition of Bio materials	06 Hours
Materials for replacements, Metallic Biomaterials and ceramic biomaterials steps involved in the fabrication of metallic implants, stainless steel Co-Cr-alloys Ti& its alloys, medical applications, corrosion of metallic implants.		
UNIT-III	Types of bio materials	08 Hours
Polymeric Biomaterials and composite biomaterials, Polymerization, polyolefin's, Polyamides, acrylic polymers, high strength thermoplastics for medical applications, deterioration of polymers. Structure, bounds on properties, anisotropy of composites, particulate composite fibrous composites, porous materials. On-absorbable or relatively Bio inert bio-ceramics Bio-degradable or restorable ceramics. Bio active or surface reactive ceramics, deterioration of ceramics		
UNIT-IV	Mechanical properties of bone and tissue	08 Hours
Polymeric Biomaterials and composite biomaterials, Polymerization, polyolefin's, Polyamides, acrylic polymers, high strength thermoplastics for medical applications, deterioration of polymers. Structure, bounds on properties, anisotropy of composites, particulate composite fibrous composites, porous materials. On-absorbable or relatively Bio inert bio-ceramics Bio-degradable or restorable ceramics. Bio active or surface reactive ceramics, deterioration of ceramics		
UNIT-V	Joint structure	08 Hours
Mechanical properties of cartilage. Different properties of particular cartilage, mechanical properties of bone. Internal fracture fixation devices, joint replacements, dental implants.		

UNIT-VI	Artificial fixation devices	06 Hours
Design of artificial fixation devices. Orthopedic fixation devices. Fundamentals of design of joint prosthesis. Mechanical testing of joint prosthesis Principles involved in study of rehabilitation engineering		
Reference Books: R1: Y. C. Fung, “Bio-mechanics, Mechanical Properties of Living Tissues”, Springer New York, Edition 2, 1993. R2: D. Dowson, V. Wright, “Introduction to Biomechanics of joints and joint replacement”, Mechanical Engineering Publication 1987. R3: C. V. Mow, A. Ralcliffe, “Bio-mechanics of Diarthrodial joints”, Springer Verlag, 1990. R4: F. H. Silver, “Bio-materials Medical Devices and Tissue Engineering”, Chapman & Hall, 1994. R5: J. B. Park, “Bio-Materials Science & Engineering”, Plenum Press, 1990. R6: B. D. Ratner & A. S. Hoffman, Bio-Materials Science an Introduction to Materials in Medicine, Academic Press, 1996. R7: K. Jacob “Hand book of Biomedical Engineering”, Academic Press, 1988.		



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5213T-C]: Retrofitting and Strengthening of R C Structures

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Basic knowledge of concrete and Reinforce cement concrete.

Course Objective:

The Objective of this course to create awareness on S.H.M. and enable students to investigate the cause effects and rehabilitation techniques in concrete structure.

Course Outcome:

On completion of the course, student will be able to–

CO1: To understand the cause of deterioration of concrete structures.

CO2: Inspect and assess the structures using techniques of visual inspection, NDT and Semi destructive testing.

CO3: To analyze different Repair system, material and techniques.

CO4: Comprehend the retrofitting and strengthening method of concrete structures.

CO5: Design strengthening of R C members.

CO6: Assess of structural health.

Course Contents

UNIT-I	Introduction	06 Hours
Needs for repair and rehabilitations of RC structure, degradation of reinforced concrete structure, major causes and sign, deterioration of concrete structures, causes of deterioration, cracking-type, causes and characteristics.		
UNIT-II	Evaluation of concrete structures	06 Hours
Evaluation of concrete structures: Conditional evaluation- definition, objectives and stages of conditional assessment, preliminary investigation-scope, methodology and output, detailed investigation-scope and methodology, In situ and laboratory testing such as non-destructive, semi destructive, corrosion test, chemical test and NDT for cracks, flaws and voids in concrete.		
UNIT-III	Repair system, material and techniques	08 Hours
Repair methodology, compatibility of repair material and concrete, material for repair-cement base, polymer modified, resin base, micro concrete and composite, repair techniques		
UNIT-IV	Retrofitting and strengthening of concrete structures	08 Hours
Design philosophy of strengthening, strengthening technique-section enlargement, composite construction, post tensioning, stress reduction, strengthening by reinforcement, strength by FRP.		
UNIT-V	Strengthening of RC members	08 Hours
Strengthening of RC members: Strengthening of beams: flexural and shear, slab, columns, footings and seismic retrofitting of R C structures using FRP.		
UNIT-VI	Quality control in concrete	06 Hours

Quality control in concrete construction, maintenance, water leakage-detection and mitigation, fire damage-detection and reparation, corrosion-detection and mitigation, demolition of concrete structures and structural health monitoring.

References Books:

R1: P. H. Emmons and G. M. Sabnis, “Concrete Repair and Maintenance”, Galgotia Publication.

R2: Repairs and Rehabilitation – Compilation from Indian Concrete Journals.

R3: G. Somerville, “Management of Deteriorating Concrete Structures”, Taylor and Francis, Publication.

R4: Concrete Building Pathology, Susan Macdonald, Blackwell Publication.

R5: C. L. Page, M. M. Page, “Durability of Cement and Cement Composites”, Wood Head Publication.

R6: ACI 440.2R-08, Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures, American Concrete Institute.

R7: Xilin Lu, “Retrofitting design of building structures”, Science Press, New York, 2010.

R8: L.C. Hollaway and J.G. Teng, “Strengthening and Rehabilitation of Civil Infrastructures Using Fiber-Reinforced Polymer (FRP) Composites”, Woodhead Publishing Series in Civil and Structural Engineering.

R9: P. C. Varghese “Maintenance, Repair & Rehabilitation & Minor Works of Building”, PHI Publication 2016.



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2023-2024 Semester - II
[CE5213T-D]: Advanced Design of Steel Structures

Teaching Scheme: TH: - 03 Hours/Week	Credit 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks Total: 100 Marks
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Course Prerequisites:

Stress strain curve, Knowledge of Design philosophy of steel structure

Course Objective:

The objective of this course is to apply of advanced concepts of design of steel structures to tabular structure, cold form and chimney etc.

Course Outcome:

On completion of the course, student will be able to–

CO1: Demonstrate the use of IS Codes and standards related to design of hoarding structures and analyze and design castellated beams using Indian Standard provisions.

CO2: Analyze and design microwave and transmission tower structures using Indian Standard provisions.

CO3: Analyze and design tubular structures using Indian Standard provisions

CO4: Recognize the behavior of Cold form light gauge section and design of Cold form light gauge section for various loading conditions.

CO5: Design chimneys subjected to various types of loads.

CO6: Design base plate of chimney and design of foundation.

Course Contents

UNIT-I	Hoarding Structures and Castellated beams	06 Hours
) Hoarding Structures: Analysis and design of hoarding structures under dead, live and wind load as per the latest IS: 875 by limit state method. b) Castellated beams: Concept, fabrication of the castellated beam from rolled steel section, design of castellated beam for bending and shears as per latest code by limit state method.		
UNIT-II	Microwave Towers and Tubular Structures	06 Hours
a) Microwave Towers: Introduction, structural configuration, function, analysis and design. b) Tubular Structures: Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per code, detailing of joints		
UNIT-III	Transmission Towers	08 Hours
Introduction, structural configuration, bracing systems, analysis and design as per code. Use working stress method		
UNIT-IV	Cold form light gauge section	08 Hours
Advantage, type of cross section, stiffened multiple stiffened and un-stiffened element, flat-width ratio, and effective design width, design of light gauge compression, tension and flexural members as per code.		
UNIT-V	Design of chimneys	08 Hours

Introduction, type, joints, lining, ladder, forces acting on chimney, design of thickness of steel plates for self-supporting chimney.

UNIT-VI

Design of base plate of chimney

06 Hours

Design of anchor bolt, design of foundation and stability of steel chimneys.

References Books:

R1: R. Chandra, “Design of steel Structures, Volume II”, Standard Book House, New Delhi.

R2: B.C. Punmia and A. K. Jain, “Comprehensive Design of steel structure”, Laxmi Publication, New Delhi.

R3: M Raghupathi, “Design of steel structures”, Tata McGraw Hill, New Delhi.

R4: S. K. Duggal, “Limit state design of steel structures”, Tata McGraw Hill Education.

R5: N. Subramanian, “Design of steel structures”, Oxford University Press.

R6: IS: 800 - 2007, “Code of Practice for General Construction in Steel”, BIS, New Delhi.

R7: IS: 800 - 1984, “Code of Practice for General Construction in Steel” BIS, New Delhi.

R8: IS: 801 - 1975, “Code of Practice for use of cold formed light gauge steel structural members in general building construction”, BIS, New Delhi.

R9: IS: 802(Part I and II)-1978, “Code of practice for use of structural steel in overhead transmission line towers”, BIS, New Delhi.

R10: IS:806-1988, “Code of practice for use of steel tubes in general building construction”, BIS, New Delhi.

R11: 875 (Part 1, 2 and 3) –1987, “Code of practice for design loads for buildings and structures”, BIS,

R12: IS: 811-1987, “Specification for cold formed light gauge structural steel sections”, BIS, New Delhi.



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5214L]: Lab Practice III

Teaching Scheme: P: - 04 Hours/Week	Credit 02	Examination Scheme: ISCE: 60 Marks ESE: 40 Marks Total: 100 Marks
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Course Prerequisites:

Concepts of Concrete technology and geotechnical engineering.

Course Objective:

To make students to learn principles of Analysis of Stress and Strain, to apply the Finite Element Method for the analysis of one- and two-dimensional problems. To evaluate the stress and strain parameters and their inter relations of the continuum.

Course Outcome:

After completion of this course students shall be able to

CO1: Operate Equipment's of NDT.

CO2: Design Concrete mix

CO3: Estimate soil and rock parameters.

Course Contents

Experiment -I	NDT 1
Use of Schmitz hammer to estimate in-situ strength of concrete and estimate of depth of carbonation.	
Experiment -II	Admixture Test
Testing on Admixtures	
Experiment -III	Concrete Mix
Preparation of self-compacting concrete, workability test	
Experiment-IV	Mix Design
Hands on training to prepare mix design. (Industry Visit)	
Experiment-V	Shear Parameters
Evaluation shear parameters of soil using tri-axial test.	
Experiment-VI	Shear Parameters
Evaluation shear parameters of soil using box-shear test	
Experiment-VII	Site Visit
Study of soil exploration report and site investigation.	

References Books:

R1: IS 10262 :2009 Concrete Mix Proportioning - Guidelines

R2: IS 13805: 2004 General Standard for Qualification And Certification Of Non-Destructive Testing Personnel — Specification

R3: IS 2720-11:2002 Methods of test of soils



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First Year M. Tech Civil (Structural Engineering)

Academic Year – 2023-2024 Semester - II

[CE5215L]: Lab Practice IV

Teaching Scheme: P: - 02 Hours/Week	Credit 01	Examination Scheme: ISCE: 30 Marks ESE: 20 Marks Total: 50 Marks
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Course Prerequisites:

Basic Understanding of Programming, Mathematical Knowledge, Logical Thinking

Course Objective:

To make students to learn Matlab programming.

Course Outcome:

After completion of this course students shall be able to

CO1: Understand the fundamentals of MATLAB environment and navigate the basic features.

CO2: Use MATLAB as a simulation tool

Course Contents

Experiment -I

Introductory Sessions Of MATLAB Training Course

Experiment -II

Handling Data And Data Flow In MATLAB.

Experiment -III

File Editing And Debugging In MATLAB

Experiment-IV

MATLAB Programming I

References Books:

R1: Introduction To Matlab For Engineering Students, David Houcque , Northwestern University

R2: MATLAB: A Practical Introduction to Programming and Problem Solving 5th Edition, by Dorothy C. Attaway



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First Year M. Tech Civil (Structural Engineering)
Academic Year – 2023-2024 Semester - II
[CE5216L]: Seminar

Teaching Scheme: P: - 04 Hours/Week	Credit 02	Examination Scheme: ISCE: 60 Marks ESE: 40 Marks Total: 100 Marks
Course Prerequisites: Basic Understanding of Programming, Mathematical Knowledge, Logical Thinking		
Course Objective: To make students to learn Matlab programming.		
Course Outcome: After completion of this course students shall be able to CO1: Understand the fundamentals of MATLAB environment and navigate the basic features. CO2: Use MATLAB as a simulation tool		
Course Contents		
Experiment -I		
Introductory Sessions Of MATLAB Training Course		
Experiment -II		
Handling Data And Data Flow In MATLAB.		
Experiment -III		
File Editing And Debugging In MATLAB		
Experiment-IV		
MATLAB Programming I		
References Books: R1: Introduction To Matlab For Engineering Students, David Houcque , Northwestern University R2: MATLAB: A Practical Introduction to Programming and Problem Solving 5th Edition, by Dorothy C. Attaway		