GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)

An Autonomous Institute

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus For

Master of Technology

(Structural Design)-1st Year

(Effective from the Session: 2025-26)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	Lecture (L) per week	1- Credit
2	Practical (Lab) per week	1- Credit
3	Seminar per week	2 -Credit
4	Project per week	2 -Credit

2. RANGE OF CREDIT

A credits of 87 for a student to be eligible to get Post Graduate degree in Engineering.

3. STRUCTURE OF POSTGRADUATE ENGINEERING PROGRAM (M.TECH)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	32*
2	Professional Elective Courses (Relevant to chosen specialization/branch)	8*
3	Multidisciplinary Open Elective Courses	6*
4	Foundation Elective Courses	3*
5	Mandatory Learning course	3*
6	Seminar	6*
7	Lab Courses	5*
8	Project	2*
9	Dissertation	22*
	Total Credits	**87***

*Minor variation is allowed as per need of the respective disciplines.

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
3	Multidisciplinary Open Elective Courses	OEC
4	Foundation Elective Courses	FEC
5	Mandatory Learning Course	MLC
6	Seminar	SM
7	Lab Courses	LC
8	Project	PROJ
9	Dissertation	DISS

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.), DELHI-NCR
Scheme of Studies and Examination
M.Tech (Structural Design) – 1st Semester
***w.e.f.* 2025-26**

Sr. No.	Category	Course Code	Course Title	Lectures per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in Hours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-MTSD-101A	Material Technology	4	0	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-MTSD-103A	Advanced Structural Analysis	4	0	0	4	4	40	60		100	3
3	Professional Core Courses	PCC-MTSD-105A	Pre-Stressed Concrete Design	4	0	0	4	4	40	60		100	3
4	Professional Core Courses	PCC-MTSD-107A	Design of Structures-I	4	0	0	4	4	40	60		100	3
5	Professional Core Courses	PCC-MTSD-109A	Material Science	4	0	0	4	4	40	60		100	3
6	Lab Courses	LC-MTSD-111A	Structural Engineering Laboratory	0	0	2	2	1	25		25	50	3
7	Lab Courses	LC-MTSD-113A	Computational Laboratory-I	0	0	2	2	1	25		25	50	3
8	Seminar	SM-MTSD-115A	Seminar-I	0	0	2	2	2	50			50	
Total Credits								**24**				**650**	

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.), DELHI-NCR
Scheme of Studies and Examination
M.Tech (Structural Design) –2nd Semester
***w.e.f.* 2025-26**

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in Hours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-MTSD-102A	Stability of Structures	4	0	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-MTSD-104A	Design of Structures-II	4	0	0	4	4	40	60		100	3
3	Professional Elective Courses	Refer Table -I	----------	4	0	0	4	4	40	60		100	3
4	Multidisciplinary Open Elective Courses	Refer Table -II	----------	3	0	0	3	3	40	60		100	3
5	Foundation Elective Courses	Refer Table -III	----------	3	0	0	3	3	40	60		100	3
6	Lab Courses	LC-MTSD-106A	Structural Engineering Design Practice Lab	0	0	2	2	1	25		25	50	3
7	Lab Courses	LC-MTSD-108A	Computational Laboratory-II	0	0	2	2	1	25		25	50	3
8	Seminar	SM-MTSD-110A	Seminar-II	0	0	2	2	2	50			50	
Total Credits								**22**				**650**	

Course code	**PCC-MTSD-101A**				
Category	**Professional Core courses**				
Course title	**Material Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives:	The objectives of this course are to ● To provide foundational knowledge of the composition, properties, and behavior of cement, concrete, and construction metals. ● To equip students with the skills to apply mix design, mechanical testing, and quality control techniques to improve material performance in construction. ● To enable students to analyze the impact of environmental factors and material imperfections on the durability and strength of construction materials.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Identify the factors influencing the strength, durability, and deformation of construction materials, including concrete.	Level 1: Remember
CO2	Explain mechanical testing methods and mix design principles for quality control in concrete, incorporating stress-strain behavior and failure theories.	Level 2: Understand
CO3	Determine fatigue and creep mechanisms, considering material properties and temperature effects under various loading conditions.	Level 3: Apply
CO4	Analyze the impact of material imperfections on construction performance and recommend suitable measures for improvement.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Cement and Concrete: Portland cement: chemical composition, hydration of cement, structure of hydrated cement, mechanical strength of cement gel, water held in hydrated cement paste, heat of hydration, cements of different types, factors affecting the strength of concrete, elasticity, shrinkage, and creep of concrete, durability of concrete: permeability of concrete, chemical attack of concrete, air-entrained concrete, thermal properties of concrete

Unit-II

Mechanical Properties and Strength of Concrete and Metals: Mechanical tests of hardened concrete, lightweight and high-density concrete, mix design, statistical quality control, biaxial strength of concrete, fiber-reinforced concrete, metals: behavior of common constructional metals in tension and compression, true stress-strain curve for mild steel in simple tension, theories of failure, yield surfaces.

Unit-III

Fatigue properties: nature of fatigue failure, fatigue strength for completely reversed stresses, fatigue strength with superimposed static stress, factors influencing fatigue strength, temperature and creep properties: low temperature properties, high temperature properties, creep-stress-time-temperature relations for simple tension, mechanics of creep in tension.

Unit-IV

Material Structure and Deformation: Structure of materials and their imperfections, deformation of crystals, theory of dislocations **.**

Suggested Readings

- A.M. Neville, J.J. Brooks, Concrete Technology, Low Priced Edition, Pearson
- A J Martin, Mechanical behavior of engineering materials.
- J. Martin: Communication Satellite System, PH Englewood.
- S P Timoshenko, Strength of materials- Part II
- M. S. Shetty, Concrete technology- Theory & Practice, S.Chand & Company New Delhi, 2005
- M.L. Gambhir, Concrete Technology: Theory And Practice

Useful Video links:

Unit No.	Topics	Links
1	**Cement and Concrete**	https://archive.nptel.ac.in/courses/105/102/105102012/
2	**Mechanical Properties and Strength of Concrete**	https://www.youtube.com/watch?v=m8UeEOYGBNE
3	**Fatigue properties**	https://www.youtube.com/watch?v=Yx-bIKo-_wg
4	**Material Structure and Deformation**	https://www.youtube.com/watch?v=ZKtp6SLu7Mk

Course code	**PCC-MTSD-103A**					
Category	**Professional Core courses**					
Course title	**Advanced Structural Analysis**					
Scheme and Credits	L	T	P	**Credits**	**Semester-I**	
	4	0	0	4		
Course Objectives:	The objectives of this course are to • To equip students with foundational knowledge of flexibility and stiffness matrix methods in structural analysis. • To develop an understanding of the principles and behaviors of beams, frames, and trusses under various loading conditions. • To enable students to apply analytical methods for effective design and evaluation of structural systems.					
Class work	40 Marks					
Exam	60 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Define the degree of indeterminacy in beams and frames by the flexibility method.	Level 1: Remember
CO2	Describe truss types on base of load distribution in truss members.	Level 2: Understand
CO3	Calculate internal forces in truss structures by using the method of joints and sections.	Level 3: Apply
CO4	Analyze stiffness matrices for beams and frames, considering boundary conditions.	Level 4: Analyze

Note: : Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Flexibility Matrix Method for Analysis of Beams and Frames: Introduction to Flexibility Matrix Method, Flexibility Method, Structural Indeterminacy, Compatibility Conditions, Superposition Principle, Analysis of Beams, Flexibility Coefficient, Bending Moment, Moment-Curvature Relationship, Boundary Conditions and Their Effects on Analysis, Analysis of Frames, Frame Structure, Flexibility Matrix, Joint Reactions.

Unit-II

Flexibility Matrix Method for Analysis of Trusses: Introduction to Truss Structures, Truss, Pin-Jointed, Load Distribution in Trusses, Types of Trusses (e.g., Pratt, Warren), Analysis of Trusses, Method of Joints, Method of Sections, Internal Forces in Truss Members, Effect of External Loads on Truss Stability

Unit-III

Stiffness Matrix Method for Analysis of Beams and Frames: Introduction to Stiffness Matrix Method, Stiffness Method, Structural Stiffness, Relationship Between Forces and Displacements, Formation of the Global Stiffness Matrix, Analysis of Beams, Stiffness Matrix for Beams, Deflection, Importance of Boundary Conditions, Variations in Cross-Section and Material Properties, Analysis of Frames, Nodal Displacement, Load Application, Assembly of Global Stiffness Matrix, Effects of Load Types on Frame Behavior

Unit-IV

Stiffness Matrix Method for Analysis of Trusses: Analysis of Trusses, Axial Deformations, Global and Local Stiffness Matrices, Stiffness of Truss Members, Stability Analysis of Truss Systems, Stability and Integrity, Buckling, Safety Factors, Failure Modes in Truss Members, Design Considerations for Stability under Load

Suggested Readings

- Matrix Analysis of Framed Structure by Gere & Weaver.
- Structural Analysis by Ghali & Neville.
- Computer Analysis of Structural System by Fleming J.F.
- Computer Methods of Structural Analysis by Beaufait, Rowan, Hadley, Heckett.
- Intermediate Structural Analysis by C.K.Wang.

Useful Video links:

Unit No.	Topics	Links
1	**Flexibility Matrix Method for Analysis of Beams and Frames**	https://www.youtube.com/watch?v=N6jD-m48gr8&list=PLbRMhDVUMngeZatm4MIOKG4sHxXuB_yri&index=22 & https://www.youtube.com/watch?v=amKFttgBUnc&list=PLbRMhDVUMngeZatm4MIOKG4sHxXuB_yri&index=27
2	**Flexibility Matrix Method for Analysis of Trusses:**	https://www.youtube.com/watch?v=T2drnetYhIA&list=PLbRMhDVUMngeZatm4MIOKG4sHxXuB_yri&index=17
3	**Stiffness Matrix Method for Analysis of Beams and Frames**	https://www.youtube.com/watch?v=N6jD-m48gr8&list=PLbRMhDVUMngeZatm4MIOKG4sHxXuB_yri&index=22 & https://www.youtube.com/watch?v=amKFttgBUnc&list=PLbRMhDVUMngeZatm4MIOKG4sHxXuB_yri&index=27
4	**Stiffness Matrix Method for Analysis of Trusses**	https://www.youtube.com/watch?v=T2drnetYhIA&list=PLbRMhDVUMngeZatm4MIOKG4sHxXuB_yri&index=17 Mk

Course code	**PCC-MTSD-105A**				
Category	**Professional Core courses**				
Course title	**Pre-stressed Concrete Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • To provide a comprehensive understanding of the principles and applications of prestressed concrete in structural design. • To equip students with knowledge of materials and techniques used in prestressing, including the properties of high-strength concrete and prestressing steel. • To develop skills for designing prestressed concrete structures, focusing on the determination of flexural stresses, design considerations, and limit state methodology.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define the concepts and materials used in prestressed and reinforced concrete structures.	Level 1: Remember
CO2	Explain various methods and the behavior of prestressing steel in prestressed concrete.	Level 2: Understand
CO3	Examine prestress losses and their effects on deflections in prestressed structures.	Level 3: Apply
CO4	Analyze the Limit State Method for designing prestressed concrete elements.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Prestressed Concrete: Introduction of Prestressed Concrete, Definition, Comparison with Reinforced Concrete, Advantages and Disadvantages **.**

Unit-II

Basic Principles and Materials: Review (Analysis) Basic Principles, Determination of Concrete Flexural Stresses, Basic Concept Method, C Line Method, Load Balancing Method, Classification of Members, Materials for Prestressed Concrete, High Strength Concrete, Short-term & Long-term Properties**.**

Unit-III

Prestressing Steel and Effects: Prestressing Steel, Steel Relaxation and Other Effects, Auxiliary Materials, Prestress Losses, Stresses in Steel Due to Loads, Kem Points, Cracking Moment, Deflection Under Service Conditions of Loading and Prestressing, Determination of Strength in Bending, Shear, and Bond.

Unit-IV

Design Considerations: Preliminary Design Considering No Tension in Concrete, Elastic Design Allowing and Considering Tension, Shapes of Concrete Sections, Dimensioning and Proportioning of Section Profile, Shear Design, Bond, Bearing and End Block Design, Introduction of Limit State Method**.**

Suggested Readings

- T. Y. Lin and H. Burns Ned, Design of Prestressed concrete structures, John Willey & Sons, New York-1982.
- Y. Guyen, Prestressed concrete Vol-I & Vol.-II, John Willey & Sons, New York-1960.
- E. W. Bennet, Prestressed concrete theory & design, Chapman & Hall, London-1962.
- Design of Prestressed Concrete by Gilbert & Mickleborough
- N. Krishnaraju, Prestressed concrete,Tata McGraw-Hill, New Delhi-2004
- S. K. Mallik and A. P. Gupta, Prestressed concrete, Oxford & IBH, New Delhi-1982.

Useful Video links:

Unit No.	Topics	Links
1	**Prestressed Concrete**	https://youtu.be/4KYPltsNAWs?si=Vnoy1AdghHXIUG6M
2	**Classification of Members**	https://youtu.be/Vdx2dNGsuEM?si=hCeeN48mCELxP5Je
3	**Prestressing Steel**	https://youtu.be/vhXJ6ZcKb5c?si=jHZ2-2e595JXXwSC
4	**Introduction of Limit State Method**	https://youtu.be/utgnv9NIFQc?si=v67OlkZ98zVa_mYO

Course code	**PCC-MTSD-107A**				
Category	**Professional Core courses**				
Course title	**Design of Structures-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • To provide a comprehensive understanding of the principles and applications of structural steel and reinforced concrete design in engineering. • To equip students with the skills to estimate loads and design various structural members, adhering to relevant codes and standards. • To develop proficiency in analyzing and designing connections in steel structures and detailing reinforced concrete elements for effective performance.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	**Skills Demonstrated**	**RBT Level**
CO1	Recall the basic properties, advantages, disadvantages, and applications of structural steel and reinforced concrete elements.	Level 1: Remember
CO2	Describe steel members such as tension, compression, and flexural members, as well as welded and bolted connections, following IS:800 standards.	Level 2: Understand
CO3	Apply design principles to reinforced concrete elements like beams, slabs, columns, and footings, focusing on stress-strain relationships and ensuring compliance with load-bearing requirements.	Level 3: Apply
CO4	Analyze and design industrial structures, including gantry girders, steel trusses, portal frames, roofing, cladding, and purlins, under various loads such as dead, live, wind, and earthquake.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Basics of Structural Steel: Role of Design Engineer, Properties of Structural Steel, Merits and Demerits of Structural Steel over Reinforced Concrete Structures, Components & Terminology.

Load Estimation and Design Members: Load Estimation, Choice of Sections, Design of Tension Members, Compression Members, Flexure Members, and Beam-Column Junctions, Codal Provisions of IS:800.

Unit-II

Industrial Steel Structures: Steel Structure Design, Analysis and Design for Gantry Girders, Industrial Structures with Steel Trusses and Portal Frames. Typical Configuration with Various Elements, Load Assessment (Dead Load, Live Load, Wind Load, and Earthquake Load), Different Roofing and Cladding Alternatives and Their Design, Types of Purlins and Their Design.

Unit-III

Welded Connections: Advantages of Welding, Fundamentals and Methods of Welding, Types of Joints, Welding Symbols, Inspection of Welding, Codal Provisions, Design of Typical Welded Connections. **Bolted Connections:** Types of Bolts, Codal Provisions, Design of Typical Bolted Connections.

Unit-IV

Reinforced Concrete Design: Design Approach, Stress-Strain Relationships for Concrete and Steel, Theory for Flexural Strength, Strength of Members with Flexure. Strength of Members with Flexure and Axial Load, Strength of Members with Shear, Bond and Anchorage, Service Load Behavior, Design of Various Structural Elements (Beams, Slabs, Stairs, Columns, Walls, Footings, etc.), Reinforcement Detailing for Various Structural Elements Along with Beam-Column Joints.

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Suggested Readings

- Design of Steel Structures - by Bresler & Lin.
- Theory of Modern Steel Structures - by Linton Grinter.
- Design of Steel Structures - by P. Dayaratnam.
- Reinforced Concrete Structural Elements (behaviour, analysis & design) by P.Purushothoman.
- Practical Design of Reinforced Concrete by Russell S. Fling.
- Design of Reinforced Concrete Structures by Ashok Kumar Gupta.

Useful Video links:

Unit No.	Topics	Links
1	**Introduction of Structural Steel design**	https://youtu.be/CNE4hk_SGTo?si=ImEvuX-npfKnZ1-r
2	**Types of Purlins and Their Design**	https://youtu.be/ewUdYOgvEfQ?si=2FSMtBK-kUaajV3Z
3	**Types of Joints**	https://youtu.be/xQc8EdLwqRc?si=5tkdUC1euxFnCPxr
4	**Theory for Flexural Strength**	https://youtu.be/GkFgysZC4Vc?si=RVmmgdnSlF3PKRlo

Course code	**PCC-MTSD-109A**				
Category	**Professional Core courses**				
Course title	**Material Science**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • To provide a comprehensive understanding of material classifications, properties, and atomic bonding in crystalline and non-crystalline solids. • To equip students with the knowledge of multiphase solids and heat treatment processes, including phase diagrams and the effects of alloying elements. • To develop proficiency in analyzing the structure and performance of ceramics, polymers, and composites, focusing on their applications in civil engineering.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define materials based on their structure, bonding, crystal imperfections, and diffusion processes in solids.	Level 1: Remember
CO2	Understand material properties, selection criteria, and heat treatment processes for steels and alloys.	Level 2: Understand
CO3	Apply knowledge of materials, including composite types like fiber-reinforced and laminar-reinforced, in industries such as construction and manufacturing.	Level 3: Apply
CO4	Analyze the behavior and applications of advanced materials, including composites, for industrial purposes.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts (2 from each unit/section) of 1.5 marks each and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Material Classifications and Properties: Material classifications and important properties: Requirements and selection factors. Crystalline, no crystalline, atomic bonding and generalized properties, crystal structure, crystal planes & directions, crystal imperfections, diffusion mechanism of solid and its application.

Unit-II

Multiphase Solids and Heat Treatment: Structure, properties and control of multiphase solids: Solid solutions, home rathery's rules for alloys, system, phases and structural constituents, phase diagrams and transformation; iron-carbon system end T.T.T. diagram, heat treatment of steel and other alloys, effect of alloying elements on steel, case hardening and surface treatment

Unit-III

Ceramic and Organic Materials : General structure and properties of ceramics, silicate glass, refractory, abrasives etc. Polymer and polymerization, structure and properties of plastics, rubber etc.

Composite material: Component and types (dispersion reinforced, laminar reinforced fiber reinforced) and applications like Ferro cement, reinforced glass and polymer concrete.

Unit-IV

Composite Materials and Performance in Service: Cement and concrete: Hydration mechanism, microstructure and related properties, constituents and admixture, high strength concretes. Structure property relationship in concrete.

Performance of material in service: Corrosion and oxidation, fracture and fatigue, performance

Under high temperature, radiation damages.

Suggested Readings

- Elementary Material Science-By Lawrence
- Material Science and Metallurgy-By Khanna
- Material Science-By R Gupta
- Material Science-By J Patel
- Concrete-By P.K.Mehta Testing, design tool for Microprocessor Development

Useful Video links:

Unit No.	Topics	Links
1	Material classifications	https://youtu.be/5EiZjZjG-IY?si=qWcX-3qZRduOet3R
2	Polymer and polymerization	https://youtu.be/rkT_6sIskPc?si=sNIYfma8aUgjo7PQ
3	Composite Materials	https://youtu.be/0kB0G6WKhKE?si=POY4ph1xvMqJvbdi
4	Corrosion	https://youtu.be/Vd8Kvz39msQ?si=RRgZ7PAmCF6qTwEQ

Course code	**LC-MTSD-111A**				
Category	**Lab Courses**				
Course title	**Structural Engineering Laboratory**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	0	0	2	1	
Course Objectives:	The objectives of this course are to • To introduce the fundamental components and materials used in concrete mix design and their role in construction. • To develop students' ability to evaluate the tensile and flexural properties of concrete and steel, including testing methods for structural integrity. • To equip students with the skills to analyze and assess the performance of structural elements under various conditions using both destructive and non-destructive testing methods.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

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

COs	**Skills Demonstrated**	**RBT Level**
CO1	Define the components and materials used in concrete mix design and types of steel rebars for construction.	Level 1: Remember
CO2	Explain and design concrete mixes for various grades, incorporating admixtures and ensuring compliance with standards.	Level 2: Understand
CO3	Apply principles to analyze the tensile and flexural strength of concrete and evaluate the performance of RCC beams and columns.	Level 3: Apply
CO4	Analyze experimental findings and create comprehensive reports, applying design principles to optimize construction performance.	Level 4: Analyze

List of Experiments

1. Identify the various components and materials used in concrete mix design.
2. Recognize the different types of steel rebars and rolled steel sections, including their applications in construction.
3. Design the mix of concrete for different grades and using various admixtures.
4. Evaluate the tensile and flexural strength of concrete for different grades.
5. Determine the tensile strength of different types of steel rebars and rolled steel sections.
6. Conduct tests on simply supported RCC beams to analyze flexural failure.
7. Perform tests on simply supported RCC beams to assess shear failure.
8. Test the structural integrity of RCC columns to examine their performance under load.
9. Utilize non-destructive testing methods, including the rebound hammer and ultrasonic pulse method, to measure concrete quality
10. Investigate the permeability of concrete to understand its water resistance properties.
11. Analyze the vibration characteristics of beams and plates to identify potential resonance issues.
12. Calculate the buckling load of struts to evaluate their stability under axial loads.

Useful Video links:

Exp. No.	Topics	Links
1	Identify the various components and materials used in concrete mix design	https://youtu.be/3Do2cZMUGYc?si=6tCbf08Wnqf-4hkR
2	Design the mix of concrete for different grades and using various admixtures.	https://youtu.be/qgODTPmv7pQ?si=slXzpvWBaEapcCfi
3	Evaluate the tensile and flexural strength of concrete for different grades	https://youtu.be/l6tnBsdTf34?si=GhOAYGPsm1EBisr6
4	Perform tests on simply supported RCC beams to assess shear failure.	https://youtu.be/KO3HczU-ICw?si=nAxpL57UO9mFZwef

Course code	**LC-MTSD-113A**					
Category	**Lab Courses**					
Course title	**Computational Laboratory**					
Scheme and Credits	L	T	P	**Credits**	**Semester-I**	
	0	0	2	1		
Course Objectives:	The objectives of this course are to • To provide a solid understanding of matrix operations and their applications in solving civil engineering problems through programming in C++. • To equip students with skills in structural analysis techniques, including matrix and finite element methods for evaluating trusses and beams. • To develop proficiency in using AutoCAD for 2D and 3D design, including customization and quantity extraction for construction projects.					
Class work	25 Marks					
Exam	25 Marks					
Total	50 Marks					
Duration of Exam	03 Hours					

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

COs	Skills Demonstrated	RBT Level
CO1	Define matrix operations and their civil engineering applications.	Level 1: Remember
CO2	Explain structural analysis principles using matrix and finite element methods.	Level 2: Understand
CO3	Apply programming to trusses and beams for internal forces and deflections.	Level 3: Apply
CO4	Analyze results from structural analysis to assess element behavior.	Level 4: Analyze

List of Experiments

1. Identify the basic matrix operations (addition, subtraction, and multiplication) and implement them in C++
2. Recognize the principles of structural analysis and write a C++ program to implement the matrix method for analyzing a simple frame structure
3. Design a C++ program to solve a one-dimensional finite element problem, including stiffness matrix formulation and boundary conditions
4. Analyze the internal forces in truss members using a C++ program for truss analysis (method of joints or method of sections)
5. Create a 2D floor plan of a simple building using AutoCAD, including walls, doors, windows, and apply dimensioning techniques.
6. Explain the process of 3D modeling in AutoCAD and develop a 3D model of a structural component, such as a column or beam.
7. Customize the AutoCAD environment by creating a personalized toolbar and modifying templates for civil engineering drawings.
8. Analyze and extract quantities from a 2D AutoCAD drawing, generating a material take-off report for construction purposes.

Useful Video links:

Exp. No.	Topics	Links
1	Identify the basic matrix operations (addition, subtraction, and multiplication) and implement them in C++	https://youtu.be/pzxRLRtONRQ?si=HjDm0vNIGujG6Rhw
2	Analyze and extract quantities from a 2D AutoCAD drawing, generating a material take-off report for construction purposes.	https://youtu.be/m6u4lOK6RyY?si=OlsKxKL816jaTS5g
3	Create a 2D floor plan of a simple building using AutoCAD, including walls, doors, windows, and apply dimensioning techniques.	https://youtu.be/247hzssVgS0?si=riiAciRWXzghOxcf
4	Analyze and extract quantities from a 2D AutoCAD drawing, generating a material take-off report for construction purposes	https://youtu.be/7NSn8wCYbq0?si=37W1KWXTCk4iZjqf

Course Code	**SM-MT-115A**				
Category	Seminar				
Course Title	**Seminar-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	0	0	2	**2**	
Course Objectives	The objectives of this course are to • To develop students' ability to effectively present research topics and findings by effective communication. • To improve problem-solving and critical thinking skills of the students. • To expose students to the latest trends and advancements by reviewing and discussing contemporary research.				
Assessment	50 Marks				
End Semester Examination	-				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify trends and advancements in the related field, highlighting key developments.
CO2	Analyze and synthesize research literature, conducting in-depth reviews of key studies and methodologies.
CO3	Undertake problem identification and formulation, propose solutions, and analyze the societal, economic, and environmental impact.
CO4	Prepare a well-organized report, demonstrating effective communication, critical thinking, and technical knowledge.

Overview:
This is a course designed to help M. Tech students develop research presentation skills. The focus is on selecting a topic or research paper relevant to their specialization, conducting an in-depth review, and effectively presenting the research findings.

General Guidelines:

Topic Selection	Each student is required to choose the research topic based on published review paper(s) or literature related to their relevant field. The same topic cannot be selected by multiple students.
Approval Process	The selected paper or topic must be approved by the faculty members/committee appointed by the Head of Department.
Presentation Guidelines	Each student will have 30-40 minutes for their presentation, followed by 5 minutes for Q&A.
Evaluation	The presentation will be evaluated by a committee constituted by the Head of Department. The evaluation will be based on:

Parameters for the Evaluation of Seminar

Sr. No.	Parameters	Marks Allotted	Relevant COs
1	Clarity of the topic	10	CO1
2	Literature Survey	10	CO2
3	Content Relevancy	10	CO3
4	Presentation Skills	10	CO4
5	Q&A Response	10	CO4

Course code	**PCC-MTSD-102A**				
Category	**Professional Core Courses**				
Course title	Stability of Structures				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • Understand torsional behavior in thin-walled sections, including warping effects, strain energy, and torsional buckling with Wagner's effect. • Study lateral and torsional buckling in beams, and use methods like Rayleigh-Ritz for analyzing beam-columns under different load conditions. • Use energy-based approaches to approximate critical loads in bars under various load conditions and structural variations. • Analyze inelastic buckling in columns, built-up columns, and plates, applying stability functions and concepts like Shanley's tangent and reduced modulus.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

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

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts of torsion, buckling, and bending in thin-walled open sections.	Level 1: Remember
CO2	Explain principles of lateral buckling, beam-columns, and critical load calculations in structural systems.	Level 2: Understand
CO3	Apply energy methods and advanced techniques for stability and load analysis of structural elements.	Level 3: Apply
CO4	Analyze effects of warping, shearing, and inelastic buckling in beams, columns, and plates under various loads.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Torsion of thin walled open sections, warping displacements under pure torsion,-Warping constants for rolled steel section. Strain energy in bending and torsion of members of thin walled open section including the effects of warping. Torsional buckling including the effects of Wagner's effect, flexural torsional buckling (with centroid and shear centres coincident)

Lateral buckling of beams under pure bending central point load through centre of gravity of the section. Cantilever beams with point load at the free end, Application of Rayleigh-Ritz method

Unit-II

Beam-columns on rigid supports-concentrated and continuous lateral loads with simply supported and built in-ends. Continuous beam with as axial loads. Application of trigonometric series. Inplane buckling of bars.

Unit-III

Approximate calculation of critical loads for bar structures by energy method- a bar on elastic foundation, a bar with intermediate compressive forces, bar under distributed axial loads, a bar with changes in cross section.

Unit-IV

Effects of shearing force on the critical load. Buckling of built-up columns. In-elastic in-plane buckling of columns. Tangent and reduced modulus concept, Shanley's contribution, elastic critical loads for rigid frames and triangulated structures, stability functions. Bending of thin plate. Buckling of thin rectangular plates in compression, shear and bending.

Suggested Readings:

- S.P. Timoshenko and J. M. Gere, Theory of Elastic Stability , MC Graw Hill,
- A. Kumar, Stability of Structures, Allied Publishers Ltd., New Delhi, 1998
- M.R.Horns and W.Merchang, The stability of frames, Porgamon press, 1965.
- M.Gregory , Elastic Instability Civil Engineering series,1967.
- F.Bleich, Buckling strength of Metal structures,Mc Graw Hill Book co.,1952
- T.V Galambos, Structural members and frames, Prentice-Hall INC, 1968Suggested Readings

Useful Video links:

Unit No.	Topics	Links
1	Cantilever beams with point load at the free end	https://youtu.be/sp8KE7YPr9c?si=W8lwXjeAjG0AYxWL
2	Continuous beam with as axial loads	https://youtu.be/fSRAljTN1Dk?si=_Vv_-05avGyHmZ7W
3	A bar with intermediate compressive forces	https://youtu.be/2P4WNU27gJM?si=ca1bjQTm5LCeJnK_
4	Buckling of built-up columns	https://youtu.be/ZSQ_5lRj5gI?si=dIFIhEoE2yU94nhj

Course code	**PCC-MTSD-104A**				
Category	**Professional Core courses**				
Course title	Design of Structures-II				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • Calculate deflections and crack widths in reinforced concrete beams and slabs, and understand moment redistribution. • Design reinforced concrete elements like deep beams, flat slabs, and walls under torsional and complex loads. • Develop foundation designs for elements like staircases, corbels, pile caps, and raft foundations. • Create durable designs for underground and overhead water tanks, focusing on load resistance and water-tightness.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts of deflection, crack estimation, and moment redistribution in reinforced concrete structures.	Level 1: Remember
CO2	Explain principles of designing reinforced concrete beams, slabs, walls, and foundations for various conditions.	Level 2: Understand
CO3	Apply design techniques to reinforced concrete structures, including staircases, corbels, and water tanks.	Level 3: Apply
CO4	Analyze the structural behavior and design considerations for advanced reinforced concrete systems under different loads.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Deflection of reinforced concrete beams and slabs. Estimation of crack width in reinforced concrete members. Redistribution of moments in reinforced concrete beams.

Unit-II

Design for torsion. Design of deep beams, ribbed (voided or waffle) slabs, flat slabs, flat plates, spandrel (edge) beams, reinforced concrete walls.

Unit-III

Design of staircases, corbels, brackets and nibs. Design of pile caps, beam and slab footings, raft foundations.

Unit-IV

Design of underground and overhead water tanks.

Suggested Readings:

- Limit State Design of Reinforced Concrete by Dr.P.C.Varghese.
- Advanced Reinforced Concrete Design by Dr.P.C.Varghese.
- Design and Construction of Foundations by G.P.Manning.
- Reinforced Concrete Structures by R.Park and T.Paulay.
- Reinforced Concrete Structural Elements Behaviour, Analysis and Design by P. Purushothaman.
- Reinforced Concrete Design Theory and Examples by T.J.MacGinley and B.S.Choo.

Useful Video links:

Unit No.	Topics	Links
1	Deflection of reinforced concrete beams and slabs	https://youtu.be/G7jMIC9afp8?si=oH2VhltOIWO0gGgv
2	Design for torsion	https://youtu.be/nV1cmja84Qs?si=TU7PAXId4C-IphKC
3	Design of staircases	https://youtu.be/vJCQEShrgis?si=3mWq8CLV3PQ3cthe
4	Design of underground and overhead water tanks.	https://youtu.be/eylfDRCDjoc?si=HLGRz5W5IyiOPFKG

Course code	**PEC-MTSD-112A**				
Category	**Professional Elective courses**				
Course title	Repairs and Rehabilitation of Structures				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • Conduct investigations, surveys, and material testing to assess structural distress. • Select materials and methods for surface repair, bonding, and reinforcement protection. • Use techniques to enhance strength in beams, columns, and other structural components. • Implement methods to stabilize cracks and reinforce connections for long-term durability.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Define fundamental concepts of structural investigation, material testing, and repair methods for distressed structures.	Level 1: Remember
CO2	Explain materials, technologies, and techniques used for repairing, strengthening, and stabilizing structural components.	Level 2: Understand
CO3	Apply repair, strengthening, and stabilization methods to address shear, flexural, and crack-related structural issues.	Level 3: Apply
CO4	Analyze evaluation reports and develop repair, strengthening, and protection strategies for structural systems.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Investigation and Evaluation of Distressed Structures. Preliminary investigation, detailed investigation, documentation, field observation and condition survey, sampling and material testing, evaluation, final report

Unit-II

Materials & Technologies for Repair. Surface repair, material requirements, material selection, surface preparation, reinforcing steel, cleaning, repair and protection, bonding repair materials to existing concrete, placement methods.

Unit-III

Strengthening and Stabilisation. Techniques/Design considerations, beam shear capacity strengthening

Unit-IV

Shear transfer strengthening between members, stress reduction techniques, column strengthening, flexural strengthening, connections stabilisation and strengthening, crack stabilisation.

Suggested Readings:

- Concrete Repairs & Maintenance by Peter H. Emmons & Gajanan M. Subnis.
- Repair and Rehabilitation of Concrete Structures, ACI Compilation 10.
- Bridge Repairs & Rehabilitation, ACI Compilation 29.
- Guide to Investigation of Structural Failures by Jack R. Jonney & ASCE Research Council on Performance of Structures.
- Strength Evaluation of Existing Concrete Buildings by ACI 437R-91.

Useful Video links:

Unit No.	Topics	Links
1	Detailed investigation	https://youtu.be/oeCW3D4e9Sc?si=m-8nuqvmTPA7ewxu
2	Materials & Technologies for Repair	https://youtu.be/B0x_rojIKPA?si=KMjHpNU9bTtP58RI
3	Strengthening and Stabilization	https://youtu.be/cuyzlvCbZ_M?si=E2bCqr-h4KVx42A8
4	Beam shear capacity strengthening	https://youtu.be/cuyzlvCbZ_M?si=E2bCqr-h4KVx42A8

Course code	**LC-MTSD-106A**				
Category	**Lab Course**				
Course title	**Structural Engineering Design Practice Laboratory**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	1	
Course Objectives:	The objectives of this course are to • Use STAAD. Pro and SAP for analyzing and designing multi-storey frames. • Apply software to design water tanks, bridge decks, and steel trusses. • Evaluate wind and earthquake loads and analyze dynamic response with PULSE. • Learn from real-world cases and apply software for accurate structural analysis.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts and principles of multi-storey building frames, elevated water tanks, and steel trusses.	Level 1: Remember
CO2	Explain the process of designing multi-storey building frames, elevated water tanks, and bridge decks using STAAD Pro and SAP.	Level 2: Understand
CO3	Apply design principles to analyze stability, strength, and load effects on structures using STAAD Pro, SAP, and relevant codal provisions.	Level 3: Apply
CO4	Analyze dynamic behavior, assess wind and earthquake loads, and evaluate real-world reinforced concrete case studies using PULSE software.	Level 4: Analyze

List of Experiments

1. Analysis and design of Multi-storey building frames using STAAD. Pro. SAP
2. Analysis and design of Elevated Water Tank using STAAD-Pro., SAP
3. Analysis and design of bridge decks and other structures using STAAD-Pro., SAP
4. Analysis and design of steel trusses using STAAD-Pro., SAP
5. Assessment of loads including that due to wind and earthquake on various structural elements and Systems adopting codal provisions.
6. Dynamic response of structures using PULSE software.
7. Analysis of the structure adopting software.
8. Case studies of actual buildings executed using reinforced concrete.

Useful Video links:

Exp. No.	Topics	Links
1	Analysis and design of Multi-storey building frames using STAAD. Pro	https://youtu.be/bN03Y-9R9Oo?si=9kFzg7AtjpjmejNh
2	Analysis and design of Elevated Water Tank using STAAD-Pro	https://youtu.be/7LKn4Piii5k?si=vHL4F8ojVMziehDQ
4	Analysis and design of steel trusses using STAAD-Pro.	https://youtu.be/MtgnI7dO-BE?si=XpehufrVDq7rUCGd
6	Dynamic response of structures using PULSE software	https://youtu.be/7rgN1G9pZMw?si=YuyuSzXGyV2GmwDX

Course code	**LC-MTSD-108A**				
Category	**Lab Course**				
Course title	**Computational Laboratory-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	1	
Course Objectives:	The objectives of this course are to • Apply object-oriented programming (OOP) concepts to structural engineering problems. • Develop C++ programs for structural analysis of beams, trusses, and frames. • Create finite element programs for structural analysis, including plates and shells. • Integrate OOP with finite element methods for solving complex engineering problems.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Define OOP concepts like classes, inheritance, and polymorphism for structural engineering problems.	Level 1: Remember
CO2	Explain the application of OOP principles in developing C++ programs for structural engineering.	Level 2: Understand
CO3	Apply templates and exception handling in C++ to enhance program flexibility and reliability.	Level 3: Apply
CO4	Design finite element programs for beam, truss, and frame analysis using C++ and OOP techniques.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

List of Experiments

1. Object oriented programming (OOP) - classes & objects, inheritance, overloading, polymorphism templates & exception handling.
2. C++ programming for structural engineering problems. Application of above for some structural engineering problems.
3. Construction of C++ programmes using OOP for some structural engineering problems.
4. Development of Finite Element Programming for analysis of beams, trusses, frames. ; Analysis of plates and shells using commercial software.

Useful Video links:

Exp. No	Topics	Links
1	Object oriented programming (OOP) - classes & objects	https://youtu.be/iw1Xf_33YM0?si=uK2bMibPnj2rqJf3
2	C++ programming for structural engineering problems	https://youtu.be/FbW2gCsT4cI?si=CiFXxxE6yQoEjJT4
3	Construction of C++ programmes using OOP for some structural engineering problems.	https://youtu.be/HcgLqP-5vMo?si=aSUDTGOU_g- hn5A_
4	Development of Finite Element Programming for analysis of beams	https://youtu.be/vvLx-Ge6jag?si=vRrRqvUiKprMsWFR

Course Code	**SM-MTSD-115A**				
Category	Seminar				
Course Title	**Seminar-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	**2**	
Course Objectives	The objectives of this course are to • To develop students' ability to effectively present research topics and findings by effective communication. • To improve problem-solving and critical thinking skills of the students. • To expose students to the latest trends and advancements by reviewing and discussing contemporary research.				
Assessment	50 Marks				
End Semester Examination	-				
Total Marks	50				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated	RBT Level
CO1	Identify the trends and advancements in the related field.	Level 1: Remember
CO2	Analyze and synthesize research literature with in-depth reviews of key studies and methodologies.	Level 2: Understand
CO3	Undertake problem identification, formulation, proposing solution and analyze the impact on society, economy and environment.	Level 3: Apply
CO4	Prepare a well-organized report employing elements of effective communication and critical thinking.	Level 4: Analyze

Overview:

This is a course designed to help M. Tech students develop research presentation skills. The focus is on selecting a topic or research paper relevant to their specialization, conducting an in-depth review, and effectively presenting the research findings.

General Guidelines:

Topic Selection	Each student is required to choose the research topic based on published review paper(s) or literature related to their relevant field. The same topic cannot be selected by multiple students.
Approval Process	The selected paper or topic must be approved by the faculty members/committee appointed by the Head of Department.
Presentation Guidelines	Each student will have 30-40 minutes for their presentation, followed by 5 minutes for Q&A.
Evaluation	The presentation will be evaluated by a committee constituted by the Head of Department. The evaluation will be based on:

Parameters for the Evaluation of Seminar

Sr. No.	Parameters	Marks Allotted	Relevant COs
1	Clarity of the topic	10	CO1
2	Literature Survey	10	CO2
3	Content Relevancy	10	CO3
4	Presentation Skills	10	CO4
5	Q&A Response	10	CO4

Course code	**PEC-MTSD-114A**				
Category	**Professional Elective courses**				
Course title	**Advanced Steel Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • Understand the fundamental principles of designing tension and compression members, including appropriate connections, plate girders, crane girders, and trusses for various structural applications. • To gain knowledge in the design of multi-storied buildings, silos, bins, hoppers, and steel tanks with proper staging, considering material handling and structural stability. • To develop skills in designing bridges and trusses with lateral and sway bracing, accounting for stress reversals and load distribution in structural elements. • Able to apply plastic theory in the design of continuous beams and frames, optimizing structural performance and material efficiency.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Define the fundamental concepts of tension, compression members, connections, and steel structures.	Level 1: Remember
CO2	Explain the principles of designing girders, trusses, bridges, and bracings for structural applications.	Level 2: Understand
CO3	Apply design techniques for plate girders, crane girders, steel tanks, and plastic analysis of frames.	Level 3: Apply
CO4	Analyze structural systems, including continuous beams and frames, under varying loads and stress conditions.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Design for tension and compression members, connections, design of plate girders, crane girders and trusses.

Unit-II

Multi-storyed buildings. Silos, bins and hoppers. Design of steel tanks and staging.

Unit-III

Design of bridges, trusses, lateral bracings, sway brackens and stress reversals.

Unit-IV

Design of continuous beams and frames by plastic theory.

Suggested Readings:

- K.Mukhanov, *Design of Metal structures.*
- B Bresler, T Y Lin and J B Scalzi, *Design of Steel structures*.
- P Dayaratnam, *Design of Steel Structures*

Useful Video links:

Unit No.	Topics	Links
Unit-I	Design for tension and compression members	https://youtu.be/v_G6JMj_yq8?si=WAy7FU0Sf0CGXIh0 https://www.youtube.com/live/sRTn3Y4xZ04?si=Ed4Ualvkx1dJulwX
Unit-II	Design of Multi-storyed buildings	https://youtu.be/9Dta3ImeJqQ?si=elB502NX7IQQSWlQ https://youtu.be/M6RbWiBj2LE?si=TENxEcBk48ofCeIr https://youtu.be/QxA7JcoK-_Q?si=_pMH77oOFCRmINyr https://youtu.be/-CjYSbpsqiQ?si=D6oRE1AvNGsXVPZy https://youtu.be/uCGlUKO_npQ?si=wM8653LSFhhMmXN3
Unit-III	Design of bridges	https://youtu.be/RX-WImcb73Y?si=uEobNN1TeDS6hdUU https://youtu.be/Llg1rYoZMfU?si=Qb47_yiIJukENK6c https://youtu.be/3UBrBrpW-uY?si=EC5NRa-35hxBmGG3 https://youtu.be/7HXF3oGWRlA?si=CQzzzAqpyzuQ6M1D https://youtu.be/1t_tUmLUWcE?si=BlcwDIcuTr7BnsLg
Unit-IV	Design of continuous beams and frames by plastic theory	https://youtu.be/yI3W25ofR8g?si=8pLUJznFJD6Bm9aS

Course code	**PEC-MTSD-116A**				
Category	**Professional Elective courses**				
Course title	**Construction Failures**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • Understand causes of construction failures, including design, materials, workmanship, and external factors. • Examine factors affecting concrete durability, with emphasis on corrosion and code-based solutions. • Identify causes of cracking in concrete and masonry and strategies for prevention. • Learn professional and legal responsibilities to minimize construction failures.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	Define the causes, factors, and concepts related to construction failures and durability in structures.	Level 1: Remember
CO2	Explain the mechanisms of concrete durability, reinforcement corrosion, and measures for mitigating construction failures.	Level 2: Understand
CO3	Apply strategies to identify, prevent, and mitigate cracks in concrete and masonry structures.	Level 3: Apply
CO4	Analyze professional and legal responsibilities to reduce the frequency and severity of construction failures.	Level 4: Analyze

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Meaning of construction failure, historical references, main broad causes of failures such as design deficiency, use of improper materials and poor workmanship, removal of formwork at early stage, inadequate supervision and inspection, subsidence of foundations, fire, flood, earthquake, etc.

Unit-II

Factors affecting durability of concrete structures with emphasis on corrosion of reinforcement and codal provisions for design of durable concrete structures.

Unit-III

Cracks in concrete and masonry structures their reasons and measures to reduce or/and to avoid such cracks..

Unit-IV

Professional & legal responsibility. Measures to reduce frequency and severity of constructions failures.

Suggested Readings:

- Construction Failures by Jacob Feld.
- Learning from Failures : Deficiency Design, Construction & Service by R.N.Raiker.
- Concrete Reinforced Concrete Deterioration & Protection Edited by V.Moskvin.
- Building Failures. Diagnosis and Avoidance by W.H.Ransom.
- Building Disasters & Failures by Geoff Scott.
- Common Defects in Buildings Published by HMSO, London.
- Design & Construction Failures, Lesson from Forensic Investigation by Dov Kaminetzky -
- 1991.
- The Testing of Concrete in Structure, Second Edition by J.H.Bungey.

Useful Video links:

Unit No.	Topics	Links
Unit-I	Construction failure	https://youtu.be/2Pbz7lMSPbE?si=4V5oCdrRVosuEK8a
Unit-II	Factors affecting durability of concrete structures	https://youtu.be/--JS3CsQ4Gg?si=2k-LRprR7VkMA9hN
Unit-III	Cracks in concrete and masonry structures their reasons	https://youtu.be/ez-O6c4BqRQ?si=nRFUPZzdRlZC8p4S
Unit-IV	Measures to reduce frequency and severity of constructions failures.	https://youtu.be/P4_LGI5qXZ8?si=v7Jk1exYDPaC1MDz

Course code	**PEC-MTSD-118A**				
Category	**Professional Elective courses**				
Course title	**Finite Element Method**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives:	The objectives of this course are to • To introduce the basics of FEM and its application to structural elements like bars and beams. • To develop skills in formulating stiffness matrices using weighted residual and Galerkin methods. • To understand various element types and apply FEM to plane stress, strain, and axi-symmetric problems. • To implement FEM using computational tools and commercial FEA software.				
Class work	40 Marks				
Exam	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to:

COs	Skills Demonstrated	RBT Level
CO1	**Understand** the basic principles of FEM and formulate stiffness matrices for bar and beam elements.	Level 2: Understand
CO2	**Apply** the method of weighted residuals and Galerkin method to derive element equations.	Level 3: Apply
CO3	**Analyze** structural and solid mechanics problems using different element types and isoparametric formulations.	Level 4: Analyze
CO4	**Design** commercial FEA software to model, solve, and interpret results for engineering problems.	Level 6: Create

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.

Unit-II

Beam Elements: Flexure Element, Element Stiffness Matrix, Element Load Vector.

Method of Weighted Residuals:GalerkinFinite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility andCompleteness Requirements, Polynomial Forms, Applications.

Unit-III

Types: Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.

Application to Solid Mechanics: Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.

Unit-IV

Computer Implementation of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

Suggested Readings:

- Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.
- Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.
- Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, 1991.
- Krishnamoorthy, C. S, Finite Element Analysis - Theory and Programming, McGrawHill, 1995.
- R. T. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, PHI Learning Pvt Ltd, New Delhi, 1997.
- S. S. Bhavikatti, Finite Element Analysis, New Age Publishers, 2007.Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.

Useful Video links:

Unit No.	Topics	Links
1	Assembly of Global Stiffness Matrix	https://youtu.be/hiymSIY0GDk?si=8Y8HJ4z6WRl-yTOP
2	Method of Weighted Residuals	https://youtu.be/P5t-nYmlVRU?si=d0GbpgBEM5uWGvnF
3	Isoparametric Element	https://youtu.be/PhedVyx_G8o?si=wUgySUrnNUPIo6Kw
4	FEA Software.	https://youtu.be/ul3ZbEeFHx8?si=JMOJe-GnIYQsCy9U