Academic Structure
R25: AY 2025-26 to 2028-29

School of Science & Technology
Department of Civil Engineering

M. Tech. Structural Engineering

March 2025

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Academic Structure

Semester I: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total
PSEPC101	Structural Dynamics	3	-	-	3	-	-	3
PSEPC102	Advanced Structural Analysis	3	-	-	3	-	-	3
PSEPC103	Advanced Design of Concrete Structures	3	-	-	3	-	-	3
PSEPE10X	Program Elective I	3	-	-	3	-	-	3
PSTOEXXX	Open/Multidisciplinary Elective I	2	-	-	2	-	-	2
PSTRM101	Research Methodology	2	-	-	2	-	-	2
PSEVS101	Design and Detailing of Concrete Structure Lab	-	4	-	-	2	-	2
PSEPC104	Structural Dynamics Lab	-	4	-	-	2	-	2
	Total	**16**	**08**	**-**	**16**	**4**	**-**	**20**

Th: Theory, Pr: Practical, Tu: Tutorial

Semester I: Evaluation Scheme

Course Code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				SEE	TW	POE	
		T1	T2	FET	Total				
PSEPC101	Structural Dynamics	10	10	5	25	50	-	-	75
PSEPC102	Advanced Structural Analysis	10	10	5	25	50	-	-	75
PSEPC103	Advanced Design of Concrete Structures	10	10	5	25	50	-	-	75
PSEPE10X	Program Elective I	10	10	5	25	50	-	-	75
PSTOEXXX	Open/Multidisciplinary Elective I	-	10	5	15	35	-	-	50
PSTRM101	Research Methodology	-	10	5	15	35	-	-	50
PSEVS101	Design and Detailing of Concrete Structure Lab	-	-	-	-	-	50	-	50
PSEPC104	Structural Dynamics Lab	-	-	-	-	-	25	25	50

FET – Faculty evaluation for Theory, T1, T2, Continuous Assessment Test, SEE - Semester End Examination

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Semester II: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total
PSEPC201	Finite Element Method	3	-	-	3	-	-	3
PSEPC202	Advanced Design of Steel Structures	3	-	-	3	-	-	3
PSEPC203	Earthquake Resistant Design of Structures	3	-	-	3	-	-	3
PSEPE20X	Program Elective II	3	-	-	3	-	-	3
PSEOE2XX	Open/Multidisciplinary Elective II	2	-	-	2	-	-	2
PSTRM201	Research Publications and Ethics	2	-	-	2	-	-	2
PSEVS201	Design and Detailing of Steel Structure Lab	-	4	-	-	2	-	2
PSEPC204	Structural Design Lab	-	4	-	-	2	-	2
	Total	**16**	**08**	**-**	**16**	**4**	**-**	**20**

Th: Theory, Pr: Practical, Tu: Tutorial

Semester II: Evaluation Scheme

Course Code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				SEE	TW	POE	
		T1	T2	FET	Total				
PSEPC201	Finite Element Method	10	10	5	25	50	-	-	75
PSEPC202	Advanced Design of Steel Structures	10	10	5	25	50	-	-	75
PSEPC203	Earthquake Resistant Design of Structures	10	10	5	25	50	-	-	75
PSEPE20X	Program Elective II	10	10	5	25	50	-	-	75
PSEOE2XX	Open/Multidisciplinary Elective II	-	10	5	15	35	-	-	50
PSTRM201	Research Publications and Ethics	-	10	5	15	35	-	-	50
PSEVS201	Design and Detailing of Steel Structure Lab	-	-	-	-	-	50	-	50
PSEPC204	Structural Design Lab	-	-	-	-	-	25	25	50

FET – Faculty evaluation for Theory, T1, T2, Continuous Assessment Test, SEE - Semester End Examination

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Semester III: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
PSEPC301	MOOC I	-	-	-	3	-	-	3
PSEPC302	MOOC II	-	-	-	3	-	-	3
PSEPR301	Dissertation Phase I	-	-	-	-	6	-	6
PSEOT301	Industry Internship	-	-	-	-	8	-	8
	Total	**-**	**-**	**-**	**06**	**14**	**-**	**20**
OR								
PSEPC301	MOOC I	-	-	-	3	-	-	3
PSEPC302	MOOC II	-	-	-	3	-	-	3
PSERP301	Dissertation Phase I – Research	-	-	-	-	14	-	14
	Total	**-**	**-**	**-**	**-**	**20**	**-**	**20**

Th: Theory, Pr: Practical, Tu: Tutorial

Semester III: Evaluation Scheme

Course Code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				SEE	Term work	Practical Oral/POE	
		T1	T2	FET	Total				
PSEPC301	MOOC I	-	-	-	-	50	25	-	75
PSEPC302	MOOC II	-	-	-	-	50	25	-	75
PSEPR301	Dissertation Phase I	-	-	-	-	-	100	50	150
PSEOT301	Industry Internship	-	-	-	-	-	150	50	200
OR									
PCTPC301	MOOC I	-	-	-	-	50	25	-	75
PCTPC302	MOOC II	-	-	-	-	50	25	-	75
PCTPR301	Dissertation Phase I – Research	-	-	-	-	-	200	150	350

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Semester IV: Teaching Scheme

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		Th	Pr	Tu	Th	Pr	Tu	Total credits
PSEPR401	Dissertation Phase II	-	-	-	-	20	-	20
	Total	**-**	**-**	**-**	**-**	**20**	**-**	**20**
OR								
PSERP401	Dissertation Phase II – Research	-	-	-	-	20	-	20
	Total	**-**	**-**	**-**	**-**	**20**	**-**	**20**

Th: Theory, Pr: Practical, Tu: Tutorial

Semester IV: Evaluation Scheme

Course Code	Course Name	*Theory Marks*					*Practical Marks*		Total
		Internal Assessment				SEE	Term work	Practical Oral/POE	
		T1	T2	FET	Total				
PSEPR401	Dissertation Phase II	-	-	-	-	-	350	150	500
OR									
PSERP401	Dissertation Phase II – Research	-	-	-	-	-	350	150	500

FET – Faculty evaluation for Theory, T1, T2, Continuous Assessment Test, SEE - Semester End Examination

Program Elective - I

PSEPE101: Structural Design of Bridges
PSEPE102: Repair and Rehabilitation of Concrete Structures
PSEPE203: Advanced Concrete Technology
PSEPE204: Design of Tall Structures

Program Elective - II

PSEPE201: Design of Plates and Shells
PSEPE202: Numerical Methods for Structural Engineering
PSEPE203: Advanced Design of Foundations
PSEPE204: Structural Audits

Open/Multidisciplinary Elective I

PMEOE011: Total Quality Management

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
PSEPC101	Structural Dynamics	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
PSEPC101	Structural Dynamics	**T1**	**T2**	**FET**	**Total**	**Min pass**	**Marks**	**Min pass**	**Total (Marks)**
		10	10	5	25	40%	50	40%	75

Course Description

This includes analysis of indeterminate structures sections, such as Continuous beams, trusses, portal frames, plane frame grids, and beam-column. It includes beam–column analysis, flexibility, and stiffness methods of structural analysis.

Course Objectives

- To make students learn the principles of Structural Dynamics
- To implement these principles through different methods and to apply the same for free and forced vibration of structures.
- To evaluate the dynamic characteristics of the structures

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

CO1 Explain the basics of structural dynamics and the equation of motion

CO2 Analyze the dynamic response of the SDOF system

CO3 Analyze the dynamic response of the MDOF system.

CO4 Compute the response parameters of vibrations like displacement, velocity, and acceleration

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**SDOF system**	**9**
1	1.1	Fundamentals of vibration, types of exciting forces, equivalent stiffness, Damping and types of damping, response to harmonic loading, resonance, transmissibility, support motion, and vibration isolation.	
2.0		**SDOF system subjected to periodic & impulse loading**	**9**
2	2.1	SDOF system subjected to periodic & impulse loading, Fourier series loading, sine wave pulse, rectangular pulse, and triangular pulse.	
3.0		**Machine foundation**	**9**
3	3.1	Machine foundation – Types of machine foundation, General criteria, Theory of vibration, Single degree freedom system, Soil dynamic parameters, Block type machine foundation (Checking of resonance and permissible amplitude),	
4.0		**MDOF system**	**9**
4	4.1	MDOF system - Formulation of equation of motion, structure matrices, static condensation, free vibration, Eigen value problem, Frequencies and mode shapes, Determination of natural frequencies and mode shapes by Stodola method, orthogonality conditions, Proportional Damping Matrices, Rayleigh damping	
5.0		**Fundamental mode analysis**	9
5	5.1	Fundamental mode analysis, Rayleigh method, Rayleigh-Ritz method, Dunkerly method, Response of MDOF system to dynamic loading, Mode superposition method, coupled and uncoupled equations of motions, Modal contributions	

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Text Books

1. A. K. Chopra, Dynamics of Structures: Theory & Application to Earthquake Engineering, Prentice Hall Publications.
2. Mario Paz, Structural Dynamics, CBS Publication.

References

1. R. W. Clough & Joseph Penziene, Dynamics of Structures, McGraw-Hill Publications.
2. Roy Craig, Structural Dynamics, John-Wiley & Sons.
3. Jagmohan L. Humar, Dynamics of Structures, Swets and Zeitlinger, Netherlands.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End-of-Semester Examination

1. The question paper will be of 50 marks, comprising 5 questions, each carrying 10 marks.
2. The duration of the end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. The remaining questions (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC102	Advanced Structural Analysis	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPC102	Advanced Structural Analysis	10	10	5	25	40%	50	40%	75

Course Description

This includes analysis of indeterminate structures sections, such as Continuous beams, trusses, portal frames, plane frame grids, and beam-column. It includes beam–column analysis, flexibility, and stiffness methods of structural analysis.

Course Objectives

- To impart the principles of elastic structural analysis and behaviour of indeterminate structures.
- To implement these principles through different methods and to analyse various types of structures.
- To evaluate the force and displacement parameters of the structures.

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

CO 1	Analyze beam (determinate & indeterminate) curved in plan
CO 2	Construct an Influence Line Diagram (ILD)for various indeterminate structures
CO 3	Analyze a beam–column subjected to different loading
CO 4	Analyze different structures using the stiffness & flexibility method

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**Beams curved in plan**	**9**
1	1.1	Beams curved in plan - Determinate and indeterminate beams curved in plan	
2.0		**Influence line diagram**	**9**
2	2.1	Influence line diagram - ILD for indeterminate structures, Muller Breslaus Principle, and moments distribution methods, Applications to continuous beams, portal frames, and two-hinged arches.	
3.0		**Beams & Columns**	**9**
3	3.1	Beams & Columns - Governing differential Equation, Analysis of beam-column subjected to different loading and support conditions, stiffness and carry over factors for beam-columns, fixed end actions due to various loads.	
4.0		**Flexibility Method**	**9**
4	4.1	Flexibility Method- Analysis concept of flexibility coefficient, flexibility matrix, analysis of continuous beam, truss, and portal frame, and the relation between stiffness and flexibility matrix. Stiffness Method - Member and structure-oriented stiffness Approach, stiffness Matrices of beam truss, portal frame, plane frame grid, transformation matrix, Assembly rules, and bandwidth.	
5.0		**Elasticity**	9
5	5.1	Elasticity: Analysis of Stress, Concept of Stress at a point, rectangular stress components, Stresses on an arbitrary plane, Principal stresses and planes, Stress invariants, Planes of maximum shear, Octahedral stresses, State of pure shear, Hydrostatic and Pure shear states, Plane stress and plane strain, Equilibrium equations in 3D and 2D state of stress.	

Text Books

1. Reddy C. S., Basic Structural Analysis, Tata McGraw-Hill Publications.
2. B. N. Thadani, J. P. Desai, Structural Analysis – A Matrix Approach, Ueinall Publications, Mumbai.
3. Timoshenko & Goddier, Theory of Elasticity & Plasticity, McGraw-Hill Publications.

References

1. William Weaver and James Gere, Matrix Analysis & Framed Structure, Reinhold International Company Ltd.
2. Vazirami & Ratwani, Analysis of Structure, Vol. II, Khanna Publications, New Delhi.
3. Pandit & Gupta, Structural Analysis: a Matrix Approach, Tata Mc Graw Hill Publishing Ltd.
4. A. S. Meghare, S. K. Deshmukh, Matrix Methods of Structural Analysis, Charotor Publishing House.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks, comprising 5 questions, each carrying 10 marks.
2. The duration of the end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. Remaining questions (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC103	Advanced Design of Concrete Structures	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPC103	Advanced Design of Concrete Structures	10	10	5	25	40%	50	40%	75

Course Description

This course provides an overview of the comprehensive knowledge required for the design of RC elements & structures.

Course Objectives

- To enable students to learn principles of Structural Design.
- To design different types of structures and to detail the structures.
- To evaluate the performance of the structures

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

CO 1	Design and detailing of reinforcement of the RC slender column by using relevant codes
CO 2	Design and detailing of reinforcement of RC grid slabs by using relevant codes
CO 3	Design and detailing of reinforcement of RC deep beams by using relevant codes
CO 4	Analysis and design, prepare detailed structural drawings of structural elements such as beams, columns, footings, etc., by using relevant codes

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**Design of Slender Columns**	**9**
1	1.1	Design of Slender Columns: Concentrically loaded slender columns, eccentrically loaded slender columns, slender columns subjected to axial and transverse loads, Structural behavior of columns in braced and unbraced frames, Codal procedure for design of slender columns.	
2.0		**Grid or coffered slab**	**9**
2	2.1	Grid or coffered slab: Analysis and design of grid slab by Rankine-Grashof theory, IS code method, and Plate theory. Problems on the Design of grid slab using Rankine Grashof theory. Behavior of the grid slab	
3.0		**Overhead Service Reservoir**	**9**
3	3.1	Overhead Service Reservoir: Special design considerations, Design requirements of materials, membrane analysis, and compatibility analysis of the reservoir, complete design and drawing details of an overhead service reservoir.	
4.0		**Flat Slabs**	**9**
4	4.1	Flat Slabs: Elements of flat slabs, Codal procedure for design of flat slabs, Behavior of flat slab in shear, one-way and two-way shear, Equivalent Frame Method, Openings in flat slabs, Effect of pattern loading in flat slabs.	
5.0		**Deep Beams**	9
5	5.1	Deep Beams: General features, Parameter influencing design, Flexural bending, and shear stresses in deep beams. Design provisions of IS-456, Checking for local failures, Strut, and tie analysis of deep beams, Detailing of reinforcement in deep beams.	

Text Books

1. Varghsee, P.C. Advanced Reinforced Concrete Design, Prentice Hall of India, (2002).
2. Shah V.L., & Karve S.R. Limit state theory and Design of Reinforced Concrete, Structures Publications, Pune (2003)

References

1. Krishna Raju, N., Advanced Reinforced Concrete Design, CBS Publishers and Distributors, (1986)
2. Sinha S.N., Reinforced Concrete Design, Tata-McGraw-Hill (1996).
3. Purushothaman, P., Reinforced Concrete Structure Structural Elements: Behavior Analysis and Design, Tata McGraw-Hill, (1986).

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of the end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. Remaining questions (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPE1041	Structural Design of Bridges	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPE1041	Structural Design of Bridges	10	10	5	25	40%	50	40%	75

Course Description

This study is used to provide students with an understanding of Forms of bridges suitable for the different loads acting on them, Planning & decision making on width, span arrangement, and foundation & deck types, Principles of structural analysis and structural design of bridges to meet functional demand, and the Impact of construction technology on analysis and design of bridges.

Course Objectives

- To know the study of bridges
- To know key principles in the analysis and design of bridges.

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

CO 1 Discuss the IRC standard live loads and design the deck slab-type bridges

CO 2 Analyse the box culverts for the given loading and detail the box culverts

CO 3 Design and reinforcement detailing of T-Beam bridges

Course Contents

Module	Unit	Description	Hours
1.0		**Standard specifications for road bridges**	**9**
1	1.1	Standard specifications for road bridges: Types of Bridges, choice of bridge type, Indian road congress bridge codes, width of carriageway, clearances, Load to considered DL, IRC standard live loads, impact effect, Wind load, Longitudinal forces, Centrifugal forces, Buoyancy effect, Earth pressure, temperature effect, seismic effect, etc.	
2.0		**Culverts**	**9**
2	2.1	Culverts: Types of culverts, design of reinforced concrete slab culvert, box culvert, design of deck slab of slab bridges.	
3.0		**Reinforced concrete Slab-Beam bridges**	**9**
3	3.1	Reinforced concrete Slab-Beam bridges: design of interior and cantilever slab, Pigeaud's Theory, T beam bridge cross girder design, Courbon's theory, analysis of main girder for DL & LL using IRC class AA Tracked, wheeled, class A loading. Design of the main girder with reinforcement details.	
4.0		**Substructure and Bridge Foundations**	**9**
4	4.1	Sub structure: Piers and abutments, forces due to wave action and collision Example of design of pier and abutment.Bridge Foundations: Foundation types, Pile foundation, Well foundation, Pneumatic caissons.	
5.0		**Bridge Bearings**	9
5	5.1	Bridge Bearings: different types of bridge bearings and expansion joints, forces on bearings, types of bearings, design of unreinforced elastomeric bearings, and expansion joints.	

Text Books

1. Johnson Victor. D., (2012), Essentials of Bridge Engineering, Oxford Publishing Company, New Delhi
2. Krishna Raju. N., (2014), Design of Bridges, Oxford and IBH Publishing Co., New Delhi

References

1. Concrete Bridge Practice, Analysis, Design & Economics, Dr. V. K. Raina, Tata McGraw Hills publishing company Ltd.
2. Rakshit. K. S. (2010). Design and Construction of Highway Bridges. New Central Book Agency, New Delhi.
3. Standard specifications and code of practice for road bridges, (2005) – IRC section I, II, III and IV.
4. Ponnuswamy (2008), Bridge Engineering, McGraw-Hill Education (India) Pvt Limited
5. Indian Standard Codes (latest Versions) IS 456-2000, IS 1893-2002, IS 1343-2012

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end end-of-semester examination shall be two hours.
3. Question No.1 will be compulsory and based on the entire syllabus.
4. The remaining questions (Q.2 to Q.5) will be selected from all the modules.

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Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPE102	Repair and Rehabilitation of Concrete Structures	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPE102	Repair and Rehabilitation of Concrete Structures	10	10	5	25	40%	50	40%	75

Course Description

This course will help students learn how to identify various deterioration mechanisms or damage mechanisms in concrete structures (say, deterioration of metallic reinforcement and cementitious materials). The course will discuss both the scientific aspects and their practical application while performing repair work at the site. Use of various non-destructive, partially-destructive tools to assess the condition of the structure will be discussed. Also, tips on selecting measurable parameters that are useful in deciding the further repair and maintenance practices will be provided.

Course Objectives

- To understand Repair and Retrofitting techniques for the maintenance of buildings.

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

CO 1 Estimate causes for distress and deterioration of structures

CO 2 Evaluate the corrosion mechanism and its remediation to reduce the corrosion of steel in concrete structures

CO 3 Evaluate NDT techniques for condition assessment of structures for identifying damage in structures

CO4 Use the different techniques for structural retrofitting and strengthening

Course Contents

Module	Unit	Description	Hours
1.0		**Deterioration of Structures**	**9**
1	1.1	Deterioration of Structures - Causes of deterioration of concrete, steel, masonry, and timber structures, surface deterioration, efflorescence, Causes and preventive measures.	
2.0		**Corrosion of Structures**	**9**
2	2.1	Corrosion of Structures - Corrosion mechanism, Effects of cover thickness and cracking, Methods of corrosion protection, Inhibitors, Coatings, Cathodic protection for reinforcements.	
3.0		**Inspection and Assessment of Distressed Structures**	**9**
3	3.1	Inspection and Assessment of Distressed Structures - Visual inspection – Non-destructive tests –Ultrasonic pulse velocity method – Rebound hammer technique– Pullout tests – Core test.	
4.0		**Life Cycle Assessment of Buildings and Green Project Management**	**9**
4	4.1	Materials for Repair - Special concretes and mortar, Concrete chemicals, Special elements for accelerated strength gain, Expansive cement, Polymer concrete, Ferro cement, Fibre reinforced concrete, Fibre reinforced plastics.	
	4.2	Techniques for Repair - Techniques for repairing of spalling and disintegration of structures - Grouting –Autogenous healing- Pre-packed concrete- Protective surface coating.	
5.0		**Strengthening of distressed buildings**	9

5	5.1	Strengthening of distressed buildings - Repairs to overcome low member strength, Deflection, Chemical disruption, Weathering wear, Fire leakage, Marine exposure- Use of FRP- NDT tests	

Text Books

1. Modi, P.I., Patel, C.N. (2016). Repair and Rehabilitation of Concrete Structures, PHI India, New Delhi.
2 Varghese, P.C. (2014), Maintenance, Repair & Rehabilitation and Minor Works of Buildings, PHI India, New Delhi.

References

1. IABSE, (2010). Case Studies of Rehabilitation, Repair, Retrofitting, and Strengthening of Structures, Volume 12, Structural Engineering Documents (SED), Switerzland.
2. Bhattacharjee, J. (2017), Concrete Structures Repair Rehabilitation and Retrofitting, CBS Publishers & Distributors, New Delhi.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. Remaining questions (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPE103	Advanced Concrete Technology	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPE103	Advanced Concrete Technology	10	10	5	25	40%	50	40%	75

Course Description

This course explores the materials science of concrete and attempts to bring about an understanding of concrete behaviour from a fundamental perspective. The first part of the course discusses the structure and properties of concrete-making materials. This is followed by mixture proportioning of high-performance concrete, and a study of selected topics regarding fresh and hardened concrete behaviour.

Course Objectives

- To understand advanced concreting methods for building structures.

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

CO 1 Learn the manufacturing of cements, their hydration, and microstructure.

CO 2 Recognize the effects of the rheology and early-age properties of concrete on its long-term behaviour

CO 3 Develop an advanced knowledge of the mechanical performance of cement-based materials and creep, and the shrinkage of concrete.

CO 4 Use various chemical admixtures to design cement-based materials with mechanical and durability properties

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**Cement production and composition**	**9**
1	1.1	Cement production and composition -history, manufacture of cement, kiln reaction, their role in strength development, Cement Classification, Cement chemistry - the hydration reactions, morphology of the main hydration products, interfacial transition zone (ITZ), pore system, classification of pores, physical state of water in cement paste, pore volume measurements.	
2.0		**Aggregates for concrete**	**9**
2	2.1	Aggregates for concrete - basic properties of aggregates, advance characteristics, effect of the aggregates on the properties of concrete, relationship between aggregate properties and concrete properties, ITZ, alkali aggregate reaction.	
3.0		**Chemical admixtures**	**9**
3	3.1	Chemical admixtures - Accelerator, retarder, water reducing elements, plasticizer, and super-plasticizer, their functions and dosage. Self-curing admixture.	
4.0		**Mineral admixtures**	**9**
4	4.1	Mineral admixtures - Pozzolanic Reaction, Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag, and Metakaoline and their effects on concrete properties	
5.0		**Creep and shrinkage**	9
5	5.1	Creep and shrinkage - Plastic Shrinkage, Drying Shrinkage, Autogenous Shrinkage and Self-desiccation, Creep of Cement Paste, factors affecting and how to measure shrinkage and creep of concrete.	

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Text Books

1. Mehta, P. K., and Monteiro, P. J. M., 'Concrete: Microstructure, Properties and Materials,' Fourth Edition (Indian Edition), McGraw Hill, 2014.
2. Neville, A. M., 'Properties of Concrete,' Pitman Publishing, Inc., MA, 1981.

References

1. Hewlett, P. C., Ed., 'Lea's Chemistry of Cement and Concrete,' Fourth Edition, Arnold Publishers, NY, 1998.
2. Taylor, H. W. F., 'Cement Chemistry,' Academic Press, Inc., San Diego, CA, 1990
3. Lea, F. M., 'The Chemistry of Cement and Concrete,' Chemical Publishing Company, Inc., New York, 1971.
4. Mindess, S., and Young, J. F., 'Concrete,' Prentice Hall, Inc., NJ, 1981
5. J. Newman and B. S. Choo, Eds., 'Advanced Concrete Technology', Four Volume Set, Elsevier, 2003

Internal Assessment (T1, T2 and FET)

3. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
4. FET shall be assessed for 5 marks separately.

End Semester Examination

6. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
7. The duration of end-of-semester examination shall be two hours.
8. The students need to solve all 5 questions.
9. Question No.1 will be compulsory and based on the entire syllabus.
10. Remaining questions (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPE104	Design of Tall Structures	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPE104	Design of Tall Structures	10	10	5	25	40%	50	40%	75

Course Description

This course aims to equip engineers with advanced knowledge of multi-disciplinary aspects of planning, system selection, modeling, analysis, and design of tall buildings. The course objectives and content have been set/designed keeping in view the overall design process involved in a typical high-rise building

Course Objectives

- To understand the design and analysis of high-rise buildings..

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

CO 1 Explain the principles of stability of tall buildings

CO 2 Design the tall buildings for earthquake and wind resistance

CO 3 Evaluate the performance of tall structures for strength and stability against buckling and torsion.

CO 4 Design of various components of tall buildings, chimneys, and shear walls.

Course Contents

Module	Unit	Description	Hours
1.0		**Design Criteria**	**9**
1	1.1	Design Criteria: Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Construction loads, Sequential loading. Wind Loading - Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading - Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads.	
2.0		**Behaviour of Various Structural Systems**	**9**
2	2.1	Factors affecting growth, Height and structural form; high-rise behaviour, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Frutiger, braced and hybrid mega system.	
3.0		**Analysis and Design**	**9**
3	3.1	Modeling for approximate analysis, accurate analysis, and reduction techniques, analysis of building as a total structural system considering overall integrity and major subsystem interaction, analysis for member forces, drift, and twist, and computerized general 3D analyses.	
4.0		**Stability of Tall Buildings**	**9**
4	4.1	Overall buckling analysis of frames, wall frames, approximate methods, second-order effects of gravity of loading, simultaneous first-order and P-Delta analysis, Transnational, Torsional instability, out-of-plumb effects, stiffness of member in stability, effect of foundation rotation. Structural elements: sectional shapes, properties, and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep, and shrinkage effects, temperature effects.	

5.0		**Design of Chimneys**	9
5	5.1	Wind pressure, Stress in chimney shaft due to self-weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference. Design of RC chimney.	

Text Books

1. Taranath B.S, "Structural Analysis and Design of Tall Buildings"- McGraw Hill
2. Bryan Stafford Smith & Alexcoull, "Tall building structures Analysis and Design"- John Wiley

References

1. T.Y Lin & D. Stotes Burry, "Structural concepts and system for Architects and Engineers"- John Wiley
2. Lynn S. Beedle, "Advances in Tall Buildings"- CBS Publishers and Distributors.
4. IS;4998 (Part i) 1992 Criteria for design of reinforced concrete chimneys.

Internal Assessment (T1, T2 and FET)

5. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
6. FET shall be assessed for 5 marks separately.

End Semester Examination

11. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
12. The duration of end-of-semester examination shall be two hours.
13. The students need to solve all 5 questions.
14. Question No.1 will be compulsory and based on the entire syllabus.
15. Remaining questions (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSTRM101	Research Methodology	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSTRM101	Research Methodology	-	10	5	15	40%	35	40%	50

Course Description

This course will provide an opportunity for participants to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches.

Course Objectives

- Understand the types of research and their applications, and the research process arising in many engineering problems.
- Practice the ethical standards in research.
- Understand the computation of the Jacobian of functions of several variables and their applications.

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

CO1 Outline different kinds of research.

CO2 Identify and state the research problem clearly

CO3 Describe the research literature review and identify gaps in the literature about a particular research issue.

CO4 Design the ethical standards in research

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**Research Fundamentals and Types:**	**6**
1	1.1	Definition and objectives of Research: Research method and research methodology, Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Philosophy and the validity and reliability of research. Objective of research. Types of Research: Pure and applied research. Descriptive and explanatory research. Qualitative and quantitative approaches: Ethical Issues in research	
2.0		**Research Process and Research Modelling**	**6**
2	2.1	Steps in the research process: Formulating the Research Problem, Literature Review, Developing the objectives, Preparing the research design, including sample Design, Relevance, interest, available data, choice of data, Analysis of data, Generalization, and interpretation.	
3.0		**Outcome of research**	**6**
3	3.1	Outcome of Research: Design of sample surveys, Sampling design, measurement and scaling, data collection, data preparation, and data analysis using various techniques. Research outcomes, Research papers, and Publications	
4.0		**Hypothesis Formulation and Testing**	**6**
4	4.1	Probability distributions. Type I and II errors, testing of mean, proportion, test for equality of means and variances of two populations, confidence interval, Z test, and $\chi 2$ test for goodness of fit, ANOVA (one-way classification)	
	4.2	Non-parametric tests: sign test, U test. Correlation and Regression Analysis: Karl Pearson's and Rank Correlation coefficient, simple linear regression: least squares method.	

5.0		Interpretation and Report Writing:	6
5	5.1	Meaning Of Interpretation, Why Interpretation?, Technique Of Interpretation, Precautions In Interpretation, Significance Of Report Writing, Different Steps In Writing a Report, Layout Of The Research Report, Mechanics Of Writing A Research Report, Precautions For Writing a Research Report	

Text Books

1. Kothari C R, Research Methodology (Methods and Techniques), 2004, New Age International Publishers, New Delhi.

References

1. Pannnerselvam, R. Research Methodology, 2014, Phi Learning Private Limited, Delhi.
2. Saravanavel P, Research Methodology, 2011, Kitab Mahal, Allahabad.
3. Kumar R. Research Methodology, 2011, SAGE Publications Asia-Pacific Ptd Singapore.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules for 10 marks.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 35 marks and comprise 5 questions, each carrying 07 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. Remaining questions (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEVS101	Design & Detailing of Concrete Structure Lab	-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term Work	Min pass	Marks	Min pass	Total (Marks)
PSEVS101	Design & Detailing of Concrete Structure Lab	50	40%	-	-	50

Course Description

This includes analysis of indeterminate structures sections, such as Continuous beams, trusses, portal frames, plane frame grids, and beam-column. It includes beam–column analysis, flexibility, and stiffness methods of structural analysis.

Course Objectives

- Interpret ultimate and serviceability limit state approaches and estimate design loads on structural elements such as beams and columns in the current structural condition.

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

- **CO 1** Interpret ultimate and serviceability limit state approaches in the current structural design philosophy
- **CO 2** Estimate design loads on structural elements such as beams and columns, consulting appropriate standards, and analyze structural elements for design actions.

List of Experiments

The students are expected to perform all the experiments listed below and submit a report of the same.

1. A mini project to be completed individually, which shall be based on the analysis and design of a G + 4 storey building having a plan area not less than 150 m2.
2. The analysis shall be done using any commercially available software, and the design of all structural members shall be done manually.
3. The detailing shall be prepared using any commercially available drafting software
4. Site visit with a report to study reinforcement detailing and pre-stressed concrete structure

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Textbook

1 Ashok K. Jain, Reinforced concrete- limit state design by, New Chand & Bros., Roorkee.

2 P.C. Varghese, Advanced reinforced concrete design, Prentice Hall of India

References

1 N. Krishnaraju, Advanced reinforced concrete design, CBS Publishers and Distributors.

2 Reinforced concrete structures VOL I & VOL II BY Jain and Jaikrishna.

3 B.C. Punmia & A.K. Jain, Reinforced concrete structures, Vol. I & VOL II

4 N. Krishnaraju, Advanced reinforced concrete design, CBS Publishers and Distributors.

Evaluation Scheme

1. Term work assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time.
2. The grades will be converted to marks as per the ‘credit and grading system’ manual and should be added and averaged.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC104	Structural Dynamics Lab	-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term Work	Min pass	Marks	Min pass	Total (Marks)
PSEPC104	Structural Dynamics Lab	25	40%	25	-	50

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

- **CO1** To study the dynamic behaviour of structures under various loading conditions.
- **CO2** To gain practical experience in conducting experiments, collecting data, and interpreting results related to structural vibrations, modal analysis, and dynamic response.

List of Experiments

The students are expected to perform all the experiments listed below and submit a report of the same.

1. Dynamics of a one-storied building frame with planar asymmetry subjected to harmonic base motion
2. Dynamics of a three-storied building frame subjected to periodic (non-harmonic) base motion
3. Dynamics of a four-storied building frame with and without an open ground floor.
4. Earthquake-induced waves in rectangular water tanks.

Textbook

1 A. K. Chopra, Dynamics of Structures: Theory & Application to Earthquak Engineering, Prentice Hall Publications.

2 Mario Paz, Structural Dynamics, CBS Publication.

References

1 R. W. Clough & Joseph Penziene, Dynamics of Structures, McGraw-Hill Publications.
2 Jagmohan L. Humar, Dynamics of Structures, Swets and Zeitlinger, Netherlands.
3 Jaikrisna, A. R. Chandrashekharan, Elements of Earthquake Engineering, South Asian Publishers.
4 Mukhopadhayay Madhujit, Structural Dynamics: Vibration and Systems, Ane Books India Publisher.

Evaluation Scheme

1. Term work assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time. The grades will be converted to marks as per the 'credit and grading system' manual and should be added and averaged.

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SEMESTER II

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC201	Finite Element Method	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPC201	Finite Element Method	10	10	5	25	40%	50	40%	75

Course Description: The course begins with an exploration of basic FEM principles, including the discretization of continuous systems into finite elements, variational formulations, and numerical integration techniques. Participants will gain proficiency in deriving and assembling element stiffness matrices considering both linear and nonlinear material behaviors.

Course Objectives

Development and assembly of element stiffness matrices ([K]) for 1-D, 2-D, and 3-D finite elements, covering both linear and nonlinear material behaviors, and applying FEM to solve relevant structural engineering problems, including static and dynamic analyses, heat transfer simulations, fluid flow modeling, and coupled-field problems.

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

CO 1 Develop and assemble element stiffness matrices

CO 2 Apply FEM to solve a variety of complex engineering problems, including static structural analyses.

CO 3 Set up simulations, conduct analyses, and interpret results, demonstrating competence in applying computational methods.

CO 4 Critically evaluate FEM analysis results, interpret structural behaviors under different loading conditions, and make informed engineering decisions based on simulation outcomes.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hrs
1.0		**Introduction to FEM:**	**9**
1	1.1	Fundamental Concept and 1-D problem- Basic concepts and procedure of FEM, principle of minimum P.E., Rayleigh-Ritz method, point collocation method, Galerkin's method, Variational Principle. Development of [k] for spring, bar, truss, beam, and frame elements, relevant structural applications.	
2.0		**2D Problem-**	**9**
2	2.1	2D Problem- Displacement function, convergence requirement and compatibility condition, Pascal's triangle, triangular and rectangular elements for plane stress and strain problems, element aspect ratio, applications to continuum..	
3.0		**Three–Dimensional problems in stress–strain analysis**	**9**
3	3.1	Three–dimensional problems in stress–strain analysis - Various types of 3D elements, development of [k] for tetrahedron, hexahedral elements. Concept of axisymmetric element, development of [k] and nodal load vector.	
4.0		**Isoparametric Elements**	**9**
4	4.1	Isoparametric Elements - Shape function, natural co-ordinate systems classification- Isoparametric, sub-parametric, super-parametric elements, 1D and 2D Isoperimetric elements, Gauss- quadrature integration.	
5.0		**Plate and shell elements**	9
5	5.1	Plate and shell elements – Formation of stiffness matrix for plate bending elements of triangular and quadrilateral shape, thin cylindrical shell elements.	

Text Books

1. M. Mukhopdhyay, Concept and Application of Finite Element Analysis, Oxford and IBH Publishing Co. Pvt. Ltd.
2. O.C Zienkiewicz & R.L Taylor, The Finite Element Method Vol. I & II, Tata McGraw-Hill

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules, and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. The remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC202	Advanced Design of Steel Structures	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPC202	Advanced Design of Steel Structures	10	10	5	25	40%	50	40%	75

Course Description

This course delves into advanced principles and methodologies in structural design, focusing on industrial buildings and specialized structural elements. Participants will explore various aspects of design, materials, and structural behaviour to develop a comprehensive understanding and practical skills in structural engineering.

Course Objectives

- Explore the characteristics of light gauge steel, analyze local buckling effects, and develop proficiency in designing compression and flexural members using light gauge steel.

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

CO 1 Apply principles and practices to design industrial buildings

CO 2 Analyze and design tubular structures

CO 3 Evaluate and design structural elements using light-gauge steel.

CO 4 Apply plastic theory principles to analyze and design continuous beams and portal frames

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**Design of Industrial Buildings**	**9**
1	1.1	Design of Industrial Buildings - Introduction, Selection of roofing and wall material, selection of bay width, structural framing, purlins, girts and eave strut, plane trusses, floor plates, end bearings, Design of Gantry girders	
2.0		**Tubular Structures**	**9**
2	2.1	Tubular Structures - Introduction, Classification, Advantages and Disadvantages, Behaviour of Tubular Sections, Minimum Thickness, combined stresses, connections, Design of Truss Elements, including purlins	
3.0		**Design of Light-Gauge Steel Section Structures**	**9**
3	3.1	Design of Light Gauge Steel Section Structures - Introduction, types of sections, material, local buckling of thin elements stiffened compression members, multiple stiffened compression elements, compression members, laterally supported flexural members	
4.0		**Plastic Behaviour of Structural Steel**	**9**
4	4.1	Plastic Behaviour of Structural Steel - Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, conditions of plastic analysis, Theorem of Plastic collapse, Methods of Plastic analysis, Plastic design of continuous beams	
5.0		**Plastic Analysis of Structures for Frames**	9
5	5.1	Plastic Analysis of Structures for Frames - Plastic theory, Plastic collapse load, conditions of plastic analysis, Theorem of Plastic collapse of frame, Methods of Plastic analysis, and design of portal frame	

Text Books

1. S K Duggal, Limit state design of steel structures, Tata McGraw-Hill Education.
2. N Subramanian, Design of steel structures, Oxford University Press.

References

1. M Raghupathi, Design of steel structures, Tata McGraw-Hill, New Delhi.
2. Neal B. G., Plastic Methods of Structural Analysis, Chapman and Hall, London.
3. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.
4. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.
5. IS: 801 - 1975, Code of Practice for the use of cold-formed light-gauge steel structural members in general building construction, BIS, New Delhi.
6. IS: 802 (Part I and II)-1978, Code of practice for use of structural steel in overhead transmission line towers, BIS, New Delhi.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. The remaining question (Q.2 to Q.5) will be selected from all the modules.

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Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC203	Earthquake-Resistant Design of Structures	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPC203	Earthquake-Resistant Design of Structures	10	10	5	25	40%	50	40%	75

Course Description

This course provides an overview of the breadth of earthquake engineering as a discipline, providing the most important knowledge and intellectual skills for students to be able to assess earthquake hazards and ground motions (shaking), and then to analyze and design structures for earthquake resistance.

Course Objectives

- To know the application of principles of planning, analysis, and design of buildings according to earthquake design philosophy

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

CO 1 Demonstrate a deep understanding of seismology.

CO 2 Analyze the impact of irregularities, architectural planning, and center of mass/rigidity on structural behaviour under seismic loading.

CO 3 Perform equivalent linear static analysis, modal spectrum analysis, linear time history analysis, and static pushover analysis to assess structural response to seismic forces.

CO 4 Evaluate and apply energy dissipating devices and base isolation principles to control vibrations and enhance structural resilience against seismic events.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Earthquake:**	**9**
1	1.1	Understanding Earth's composition and layers. Exploration of plate boundaries and their movements. Mechanisms and theories explaining earthquake occurrence. Types of seismic waves, their propagation, and effects. Measurement scales (e.g., Richter scale, moment magnitude scale) and implications. Tools for analyzing earthquake response spectra and seismic wave characteristics.	
2.0		**Impact of structural irregularities on seismic performance**	**9**
2	2.1	Center of Mass and Center of Rigidity Philosophy of Earthquake-Resistant Design. Maximum Considered Earthquake and Design-Based Earthquake. Concept of Stiffness, Flexibility, and Ductility. P-Δ Effect.	
3.0		**Numerical methods for static analysis under seismic loads:**	**9**
3	3.1	Techniques for dynamic analysis based on mode shapes and frequencies. Linear Time History Analysis. Capacity assessment of structures under incremental loading. Capacity-Based Design and Performance-Based Design. IS 1893 Code Provisions. Compliance with Indian seismic design codes and standards.	
4.0		**Structural Design. :**	**9**
4	4.1	Considerations for combining various loads in structural design. Strong Column Weak Beam Design Concept. Principles for ensuring structural integrity and safety. Design and Detailing of Beams, Columns, and Beam-Column Joints. Implementation of IS 1893 and IS 13920 provisions in RC member design.	

5.0		**Types and applications of devices to absorb seismic energy**	9
5	5.1	Principles of Base Isolation. Techniques and systems to isolate structures from seismic waves. Examples showcasing the successful application of vibration control systems in real-world projects.	

Text Books

1. P. Agarwal and M. Shrikhande – Earthquake Resistant Design of Structures, Prentice-Hall Publications.
2. Jai Krishna, A.R. Chandrashekharan and B Chandra – Elements of Earthquake Engineering, South Asian Publishers Pvt. Ltd.

References

1. IS: 1893(2016) – Indian Standard Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
2. IS:13828 – Improving Earthquake Resistance of Low Strength Masonry Buildings, 1993

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. The remaining question (Q.2 to Q.5) will be selected from all the modules.

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Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPE201	Design of Plates and Shells	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPE201	Design of Plates and Shells	10	10	5	25	40%	50	40%	75

Course Description

This course explores the derivation of elastic and plastic stress-strain relations for plate and shell elements; the bending and buckling of rectangular plates; nonlinear geometric effects; post-buckling and ultimate strength of cold formed sections and typical stiffened panels used in naval architecture; the general theory of elastic shells and axisymmetric shells; buckling, crushing and bending strength of cylindrical shells with application to offshore structures; and the application to crashworthiness of vehicles and explosive and impact loading of structures.

Course Objectives

- To know the theory of plates and shells.

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

CO 1	Apply knowledge of mathematics and engineering to understand classical plate theory
CO 2	Identify, formulate, and solve theoretical problems of a plate with various boundary and loading conditions
CO 3	Evaluate membrane and bending theory for cylindrical and doubly curved shells
CO 4	Evaluate concepts of shell foundations, funicular shell floors, ferro cement shells, and perform critical analysis and design of typical shell structures

Course Contents

Module	Unit	Description	Hours
1.0		**Plate Theory**	**9**
1	1.1	Plate Theory - Thin and Thick Plates, Small and Large Deflection Theory of Thin Plate, Assumptions in Analysis of Thin Plates, Slope Curvature, Relations, Moment - Curvature Relations, Stress Resultants, Governing Differential Equations for Bending of Plates, Various Boundary Conditions, Navier's and Levy's Solution - Rectangular Plates Subjected to Uniformly Distributed Load, Sinusoidal Load for Different Boundary Conditions	
2.0		**Navier's and Levy's Solution**	**9**
2	2.1	Navier's and Levy's Solution - Rectangular Plates Subjected to Uniformly Distributed Load, Sinusoidal Load for Different Boundary Conditions	
3.0		**Circular Plates**	**9**
3	3.1	Circular Plates - Analysis of Circular Plates under Axis-Symmetric Loading, Moment Curvature Relations, Governing Differential Equation in Polar Co-Ordinates, Simply Supported and Fixed Edges, Distributed Load, Ring Load, a Plate with a Hole at Center.	
4.0		**Shell Structures**	**9**
4	4.1	Shell Structures - Classification of Shells on the basis of Geometry, Thin Shell Theory, Equation of Shell Surfaces, Stress Resultants, Stress - Displacement Relations, Compatibility and Equilibrium Equations.	
5.0		**Membrane Analysis**	9
5	5.1	Membrane Analysis - Equation of Equilibrium for Synclastic Shells, Solution for Shells Subjected to Self-Weight and Live Load, Cylindrical	

		Shells - Equation of Equilibrium, Open Shells with Parabolic, Circular, Elliptical Directrix, Simple Problems, Shells with Closed Directrix-Circular, Elliptical-Simple Problems, Problems on Pipes Carrying Fluid/Liquid Under Pressure, Just Filled & Partly Filled.	

Text Books

1. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Grew Hill
2. Ansel C. Ugural, Stresses in Plates and Shells, Mc Graw Hill.

References

1. G. S Ramaswamy, Design and Construction of Concrete Shell Roofs, CBS Publications.
2. Chandrashekhara K., Analysis of Concrete Shells, New Age International Edition.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. The remaining question (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPE202	Numerical Methods in Structural Engineering	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPE202	Numerical Methods in Structural Engineering	10	10	5	25	40%	50	40%	75

Course Description

This study is used to explore complex systems; physicists, engineers, financiers, and mathematicians require computational methods since mathematical models are only rarely solvable algebraically. Numerical methods, based upon sound computational mathematics, are the basic algorithms underpinning computer predictions in modern systems science

Course Objectives

- To know the modern engineering techniques to solve structural engineering problems.

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

CO 1	Apply knowledge of mathematics, science, and engineering to the analysis of structural engineering problems
CO 2	Design and conduct scientific and engineering experiments, as well as analyze and interpret data
CO 3	Identify, formulate, and solve structural engineering problems
CO 4	Use modern engineering techniques for analysis and design

Course Contents

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Module	Unit	Description	Hours
1.0		**Polynomial equations in single variable:**	**9**
1	1.1	Fixed point iterative methods, interpolation, various formulae and schemes, spline interpolation, roots of equations, Newton-Raphson method, open and bracketing methods. Solution of linear equations - Gauss elimination method, Gauss–Jordan method, Cholesky‘s factorization method, Jacobi‘s method, and Gauss–Seidel method.	
2.0		**Solution of differential equations**	**9**
2	2.1	Review of Taylor‘s series and Euler‘s method. Runge–Kutta fourth order method, predictor–corrector method. Solution of eigenvalue problems by the Power method.	
3.0		**Numerical integration**	**9**
3	3.1	Numerical integration - Trapezoidal and Simpson‘s methods, Gauss quadrature method, Newton‘s – Cotes method	
4.0		**Finite difference method**	**9**
4	4.1	Finite difference method - Forward, backward, and centered finite difference approximations to the derivatives. Applications to indeterminate beams, columns, and plates.	
5.0		**Regression analysis**	9
5	5.1	Regression analysis - Least square method, polynomial functions, curve fitting. Interpolation – Polynomial approximation, Lagrange‘s method, spline interpolation.	

Text Books

1. "Numerical Methods for Engineering Problems", Krishna Raju and K.N. Muthu, Macmillan Indian Ltd., 1992.

References

1. Numerical Methods for Engineers, Chapra and Canale R.P., Tata McGraw-Hill, 2000 Edition.
2. "Numerical Algorithms", Krishnamurthy E.V. and Sen S.K., Affiliated East-West Press, 1986.

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. The remaining question (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPE203	Advanced Design of Foundation	03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSEPE203	Advanced Design of Foundation	10	10	5	25	40%	50	40%	75

Course Description

This course delves into advanced principles and methodologies in structural design, focusing on industrial buildings and specialized structural elements. Participants will explore various aspects of design, materials, and structural behaviour to develop a comprehensive understanding and practical skills in structural engineering.

Course Objectives

- Design and detail shallow foundations, including combined and strap footings.
- Design raft foundations, including flat slab and beam-slab rafts.
- Calculate the load-carrying capacity of various types of piles and design pile caps.
- Design and analyze foundations for bridges, including caissons and well foundations.

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

CO 1 Design and detail combined footings and strap footings.

CO 2 Design beam and slab rafts, including the analysis and detailing of reinforcement.

CO 3 Design and detail reinforcement for piles and pile caps.

CO 4 Design well foundations, considering the functions and stability, and apply Terzaghi's lateral stability analysis.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**Structural Design of Shallow Foundation**	**9**
1	1.1	Structural Design of Shallow Foundation: Review of limit state design of reinforced concrete. Structural design of combined footing, strap footings.	
2.0		**Structural Design of Raft Foundation**	**9**
2	2.1	Structural Design of Raft Foundation: Design flat slab rafts / mat foundations, beam and slab rafts.	
3.0		**Structural Design of Piles**	**9**
3	3.1	Structural Design of Piles: Load carrying capacity of different type of piles and detailing of reinforcement, design of pile caps.	
4.0		**Foundation for bridges**	**9**
4	4.1	Foundation for bridges: Types of caissons or well foundation, different shape of wells, components of wells, functions, and design, sinking of wells, lateral stability by Terzaghi's analysis	
5.0		**Sheeting and bracing systems in shallow and deep open cuts in different soil**	9
5	5.1	Sheeting and bracing systems in shallow and deep open cuts in different soil types - Cantilever sheet piles, Anchored sheet piles; Stability and design of braced supports. Diaphragm walls	

Text Books

1. Kurain N.P, Modern Foundations: Introduction to Advance Techniques: TataMcGrawHill,1982
2. P. C. Varghese, ―Design of Reinforced Concrete Foundations‖, PHI Learning Pvt. Ltd,New Delhi, 2009.

References

1. Nayak N. V., Foundation Design Manual, Dhanpat Rai and Sons, Delhi.
2. Winterkorn H.F. and Fang H.Y. Ed., Foundation Engineering Hand Book, Van-NostrandReynold, 1975
3. Sreenivasalu & Varadarajan, Handbook of Machine Foundations, Tata McGraw Hill
4. "Analysis and Design of substructures", Swamy Saran, Oxford and IBH Publishing Co. Pvt. Ltd., 2007.
5. IS 1892, IS 1904, IS 6403, IS 8009 (Part-I & II); IS 2950 (Part-I); IS 2974 (Part-II, III &IV); IS 2911 (all related parts)

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.
5. The remaining question (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
PSEPE204	Structural Audits	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
PSEPE204	Structural Audits	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description

Structural Audit is an overall health and performance checkup of a building, like a doctor examining a patient. It ensures that the building and its premises are safe and contain no risks. It analyses and suggests appropriate repairs and retrofitting measures required for the buildings to perform better in their service life. Structural audit is done by experienced structural consultants.

Course Objectives

- Explore the various types of structural audits.

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

CO1	Aware of causes and types of deterioration in structures
CO2	Develop skills for the use of various non-destructive tests required during the auditing of structures
CO3	Acquire knowledge of legal procedure to conduct structural audits
CO4	Prepare a structural audit report

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction to Structural Audit**	**9**
1	1.1	RC frame and masonry building: structural and non-structural system, structural elements concrete and its texture, sag and deflection in members, cracks: types and its fatality, architectural features like balconies, cornices, etc their vulnerabilities, probable damages in structural and non-structural walls, plaster and paint leakages and seepages.	
2.0		**NDT:**	**9**
2	2.1	Visual inspection techniques. Non-destructive testing (NDT) methods. Load testing: principles and procedures. Assessment of concrete quality and durability. Evaluation of steel reinforcement condition. Analysis of masonry construction and vulnerabilities.	
3.0		**Strength Evaluation of Existing Structure**	**9**
3	3.1	Strength Evaluation of Existing Structure - reserves strength, identification of critical sections, structural system and its validation, evaluation of damage in concrete and reinforcement, evaluation of building configuration.	
4.0		**Preparation of audit reports:**	**9**
4	4.1	Preparation of audit reports: structure, content, and format. Legal and ethical considerations in reporting structural conditions. Involvement of regulatory authorities in audit approvals and compliance.	
5.0		**Structural Audit Report**	9
5	5.1	Factors influencing the frequency of structural audits (e.g., building type, occupancy, environmental conditions). Importance of periodic reassessment to ensure ongoing structural integrity and compliance with safety standards.	

Text Books

1. Armer, G.S.T. (Editor), Monitoring and assessment of structures, Spon, London.
2. Douglas E Adams, Health Monitoring of Structural Materials and Components Methods with Applications, John Wiley and Sons.

References

1. Indian Standard codes related to nondestructive testing, Government Resolutions related to Structural Audits (BMC Act,etc), Field manuals and reports by Expert Consultants.
2. Wu, Z.S. (Editor), Structural health monitoring and intelligent infrastructure, Volumes 1 and 2, Balkema

Internal Assessment (T1, T2 and FET)

1. T1 (Test 1) should be based on the first two modules and T2 (Test 2) should be based on the next two modules, for 10 marks each.
2. FET shall be assessed for 5 marks separately.

End Semester Examination

1. The question paper will be of 50 marks and comprise 5 questions, each carrying 10 marks.
2. The duration of end-of-semester examination shall be two hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on the entire syllabus.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSTRM201	Research Publications and Ethics	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
PSTRM201	Research Publications and Ethics	-	10	5	15	40%	35	40%	50

Course Description

This course will provide an opportunity for participants to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches.

Course Objectives

- To know research ethics.
- To understand research approaches and their applications.

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

CO1 Identify the ethical standards in research

CO2 Analyze research literature reviews and identify gaps in the literature pertaining to a particular research issue.

CO3 Design and conduct research

CO4 Describe the outcomes of research by preparing a paper for publication or patenting

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Contents

Module	Unit	Description	Hours
1.0		**Publication ethics:**	**6**
1	1.1	Definition, introduction, and importance - best practices/standards setting initiatives and guidelines: COPE, WAME, etc. - Conflicts of interest	
	1.2	Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types - Violation of publication ethics, authorship, and contributor ship - Identification of publication misconduct, complaints, and appeals - Predatory publisher and journals.	
2.0		**Ethics with respect to science and research -**	**6**
2	2.1	Intellectual honesty and research integrity - Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) - Redundant Publications: duplicate and overlapping publications,	
	2.2	Salami slicing - Selective reporting and misrepresentation of data.	
3.0		**Open access publications and initiatives**	**6**
3	3.1	SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies - Software tool to identify predatory publications developed by SPPU - Journal finder/journal suggestion tools, such as JANE, Elsevier Journal Finder, Springer, Journal Suggester, etc.	
4.0		**Hypothesis Formulation and Testing**	**6**
4	4.1	Indexing databases, Citation databases: Web of Science, Scopus, etc. Cite Score - Metrics: h-index, g-index, i10 Index, altmetrics	
5.0		**Research Metrics:**	**6**
5	5.1	Research Metrics: Impact Factor of the journal as per Journal Citations Report, SNIP, SJR, IPP.	

Text Books

1. Gupta S. C. and Kapoor V. K, Fundamentals of Mathematical Statistics, Sultan Chand & Company New Delhi.
2. Creswell, J. W. Research design: Qualitative, quantitative, and mixed methods approach. 5th Ed. Thousand Oaks, CA: Sage, 2018.

References

1. Nicholas H. Steneck. Introduction to the Responsible Conduct of Research. Office of
2. Research Integrity. 2007. Available at: https://ori.hhs.gov/sites/default/files/rcrintro.pdf

Internal Assessment (T1, T2 and FET)

3. T1 (Test 1) should be based on the first two modules for 10 marks.
4. FET shall be assessed for 5 marks separately.

End Semester Examination

6. The question paper will be of 35 marks and comprise 5 questions, each carrying 07 marks.
7. The duration of end-of-semester examination shall be two hours.
8. The students need to solve all 5 questions.
9. Question No.1 will be compulsory and based on the entire syllabus.
10. Remaining questions (Q.2 to Q.5) will be selected from all the modules.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
PSEVS201	Design & Detailing of Steel Structure Lab	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
PSEVS201	Design & Detailing of Steel Structure Lab	Term Work	Min pass	Marks	Min pass	Total (Marks)
		50	40%	-	-	50

Course Description: This course provides a comprehensive exploration of the analysis, manual design, detailing, and practical considerations involved in prefabricated structures. Participants will engage in theoretical learning, software-based analysis, manual design calculations, drafting of construction details, and a site visit to enhance their understanding of prefabricated construction techniques.

Course Objevtives:

- Gain a thorough understanding of various steel construction methods used in industrial buildings, hangars, parking structures, chimneys, and towers.
- Acquire proficiency in using commercially available structural analysis software (e.g., SAP2000, ETABS, STAAD.Pro) to model and analyze steel structures.
- Develop skills in manually designing structural members such as beams, columns, and connections based on analysis results and in accordance with relevant design codes and standards

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

- **CO1** Develop skills in manual design calculations for structural members and detailing using drafting software.
- **CO2** Apply theoretical knowledge and practical insights from site visits to enhance project execution and reporting in prefabricated construction.

Lab work

The students are expected to perform all experiments listed below and submit a report of the same.

1. A mini project to be completed individually, which shall be based on the analysis and design of an industrial building, a hangar building, a parking structure, a chimney, or a tower
2. The analysis shall be done using any commercially available software, and the design of all structural members shall be done manually.
3. The detailing shall be prepared using any commercially available drafting software.
4. Site visit to study the prefabricated structure.

References

1. Subramanian. N., (2011), Design of Steel Structures, Oxford University Press, New Delhi.
2. IS 800 General Construction in Steel — Code of Practice

Evaluation Scheme

2. TERM WORK assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time.
3. The grades will be converted to marks as per the ‘credit and grading system’ manual and should be added and averaged.
4. Based on the above scheme, grading and TERM WORK assessment should be done.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC204	Structural Design Lab	-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term Work	Min pass	Marks	Min pass	Total (Marks)
PSEPC204	Structural Design Lab	25	40%	25	-	50

Course Description: This laboratory course provides hands-on experience and practical training in structural engineering concepts and techniques. Participants will engage in experiments, simulations, and site visits to deepen their understanding and application of structural principles.

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

- Gain hands-on experience and practical knowledge in conducting experiments related to structural engineering principles and techniques.
- Apply performance-based design principles to steel structures, optimizing design parameters to achieve desired performance objectives
- Design and detail shear walls according to IS 1893 – 2016 provisions, focusing on reinforcement detailing and construction practices.

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

- **CO1** Apply performance-based design principles to steel structures, optimizing design parameters to achieve specified performance objectives.
- **CO2** Design and detail shear walls according to IS 1893 – 2016 provisions, demonstrating proficiency in reinforcement detailing and construction practices for seismic resistance.

List of Experiments

Measure and compare parameters such as displacements, stresses, and deformations to assess the effectiveness of shear walls in enhancing structural performance.

1. Apply performance-based design principles to a steel structure model. Evaluate structural behavior under simulated seismic and gravity loads using advanced analysis techniques.
2. Design shear walls according to IS 1893 – 2016 provisions. Detail reinforcement and construction details for effective seismic resistance.
3. Investigate and assess the liquefaction susceptibility of clayey and sandy soils through laboratory tests.
4. Perform non-destructive testing (NDT) techniques, such as ultrasonic testing, rebound hammer, and electromagnetic methods, on existing concrete members.
5. Prepare a comprehensive report detailing structural observations, analysis of construction practices, and recommendations for structural improvements based on site findings.

References

1. IS 1893 (Part 1): Indian Standard Criteria for Earthquake Resistant Design of Structures
2. IS 13920: Indian Standard Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces
3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
4. Chudley, R., Construction Technology, ELBS Publishers, 2007.

Evaluation Scheme

1. TERM WORK assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time.
2. The grades will be converted to marks as per the ‘credit and grading system’ manual and should be added and averaged.
3. Based on the above scheme, grading and TERM WORK assessment should be done.

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SEMESTER III

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr /week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC301	MOOC I	Online	-	-	3	-	-

Course Code	Course Name	Evaluation Scheme (In Semester)				Semester End Exam (SEE)			Total (Marks)
		T1	T2	FET	Total	Min Pass	Marks	Min pass	
PSEPC301	MOOC I	-	-	25	25	40%	50 Online	40%	75

Course Description: This online course is designed to provide students in Structural Engineering with advanced knowledge and skills in key areas of structural analysis, design, and assessment. The course emphasizes theoretical foundations, practical applications, and the latest industry trends, preparing students for specialized roles in structural engineering and related fields.

Course Objectives:	
1	Apply learned concepts and techniques to real-world structural engineering problems through assignments, projects, and simulations through online platform.
2	Evaluate understanding and mastery of course outcomes through quizzes, exams, and practical assessments.
Course Outcomes: After the end of this course, students will be able to	
CO 1	Application of learned concepts and techniques to real-world structural engineering problems through assignments, projects, and simulations.
CO 2	Commitment to lifelong learning through engagement with emerging technologies, codes, and standards in structural engineering.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Outline	
1	NPTEL began the initiative of offering certification to students for courses. Students enroll in at least one course for 12 weeks available on MOOC in the field of Advanced Structural Analysis, Advanced Concrete Technology, Advanced Structural Design, Structural Dynamics and Earthquake Engineering, Structural Health Monitoring and Assessment, etc.
2	The official NPTEL website (nptel.ac.in) provides comprehensive information about courses offered, including course descriptions, instructors, and syllabi. It also includes details on certification and enrollment processes.
3	Every week, about 3 hrs of video content is released along with an assignment, which is evaluated and provides the student with a score.
4	Teaching Assistants (TAs) and the faculty members support the discussion forum – answering questions and clearing doubts.
Internal Assessment (FET)	
1	Internal assessment in an NPTEL course typically involves a combination of methods to evaluate student learning and progress throughout the course.
Semester End Examination (SEE)	
1	Final score=25% assignment score + 75% exam score. To be eligible for a certificate, the learner should have scored >=40% final score. E-verifiable certificates are made available on nptel.ac.in/noc, and hard copies are also dispatched to the candidates.
2	If someone wants to get a certificate from the IITs/IISc after doing the course, he/she should register for the in-person proctored certification exam that is conducted in about 100 cities across India in collaboration with an exam partner. The certification exam is not free but has a nominal fee of Rs 1100.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr /week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPC302	MOOC II	Online	-	-	3	-	-

Course Code	Course Name	Evaluation Scheme (In Semester)				Semester End Exam (SEE)			Total (Marks)
		T1	T2	FET	Total	Min Pass	Marks	Min pass	
PSEPC302	MOOC II	-	-	25	25	40%	50 Online	40%	75

Course Description: This online course is designed to provide students in Structural Engineering with advanced knowledge and skills in key areas of structural analysis, design, and assessment. The course emphasizes theoretical foundations, practical applications, and the latest industry trends, preparing students for specialized roles in structural engineering.

Course Objectives:	
1	Apply learned concepts and techniques to real-world structural engineering problems through assignments, projects, and simulations through online platform.
2	Evaluate understanding and mastery of course outcomes through quizzes, exams, and practical assessments.
Course Outcomes: After the end of this course, students will be able to	
CO 1	Application of learned concepts to real-world structural engineering problems.
CO 2	Commitment to lifelong learning through engagement with emerging technologies, codes, and standards in structural engineering.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Outline	
1	NPTEL began the initiative of offering certification to students for courses. Students enroll in at least one course for 12 weeks available on MOOC in the field of Advanced Structural Analysis, Advanced Concrete Technology, Advanced Structural Design, Structural Dynamics and Earthquake Engineering, Structural Health Monitoring and Assessment, etc.
2	The official NPTEL website (nptel.ac.in) provides comprehensive information about courses offered, including course descriptions, instructors, and syllabi. It also includes details on certification and enrollment processes.
3	Every week, about 3 hrs of video content is released along with an assignment, which is evaluated and provides the student with a score.
4	Teaching Assistants (TAs) and the faculty members support the discussion forum – answering questions and clearing doubts.
Internal Assessment (FET)	
1	Internal assessment in an NPTEL course typically involves a combination of methods to evaluate student learning and progress throughout the course.
Semester End Examination (SEE)	
1	Final score=25% assignment score + 75% exam score. To be eligible for a certificate, the learner should have scored >=40% final score. E-verifiable certificates are made available on nptel.ac.in/noc, and hard copies are also dispatched to the candidates.
2	If someone wants to get a certificate from the IITs/IISc after doing the course, he/she should register for the in-person proctored certification exam that is conducted in about 100 cities across India in collaboration with an exam partner. The certification exam is not free but has a nominal fee of Rs 1100.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr /week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPR301	Dissertation Phase I	-	-	-	-	6	-

Course Code	Course Name	Evaluation Scheme (In Semester)		Semester End Exam (SEE) OE/POE		Total (Marks)
		Term Work	Min Pass	Marks	Min pass	
PSEPR301	Dissertation Phase I	100	40%	50	40%	150

Course Description: The Dissertation Phase I typically involves laying the groundwork for the research that will culminate in the final dissertation or thesis.

Course Objectives:

1 Apply theoretical knowledge to solve problems, analyze data, and draw informed conclusions.

2 Critically evaluate information, arguments, and methodologies presented in course materials, assignments, and projects.

3 Identify and define problems related to course topics, formulate solutions, and implement them effectively.

4 Present complex information clearly and logically to both peers and external examiners.

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

CO 1 Evaluate the outcomes of implemented solutions and propose adjustments based

on analysis and feedback.

CO 2 Present complex information clearly and logically to both peers and external examiners, demonstrating proficiency in academic and professional communication.

CO 3 Apply research methodologies and techniques to investigate and explore issues within the course discipline.

CO 4 Exhibit professionalism in interactions with peers, faculty, and external examiners, reflecting responsibility and respect for academic standards.

CO 5 Foster a commitment to continuous learning and professional development in alignment with industry demands and academic expectations

Course Outline

1	Select a relevant and feasible topic within the field of Structural Engineering, demonstrating understanding of its significance and potential contribution to the discipline.
2	Conduct a comprehensive literature review to identify gaps, establish a theoretical framework, and synthesize relevant research findings related to the chosen topic.
3	Develop a well-structured and clear research proposal that includes research questions or hypotheses, objectives, rationale, methodology, and expected outcomes.
4	Design an appropriate research methodology, including data collection methods, sampling techniques, and data analysis approaches, aligned with research objectives and ethical considerations.
5	Incorporate constructive feedback from advisors and peers to refine the research proposal, enhance research methodology, and improve overall quality of the proposal.

Internal Assessment

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

1 A synopsis presentation in an academic context typically refers to a concise overview or summary of a research project or thesis, often presented before the actual research work begins or as a preliminary step in the evaluation process.

2 TERM WORK assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time.

Semester End Exam (SEE) OE/POE

1 Assessment criteria may include supervisor evaluations, project deliverables, and reflective assessments by the student during external oral examination.

Course Code	Course Name	Teaching Scheme (Hr /week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEOT301	Industry Internship	-	-	-	-	8	-

Course Code	Course Name	Evaluation Scheme (In Semester)		Semester End Exam (SEE) OE/POE		Total (Marks)
		Term Work	Min Pass	Marks	Min pass	
PSEOT301	Industry Internship	150	40%	50	40%	200

Course Description: An industry internship course provides a valuable opportunity for students to bridge the gap between academic learning and professional practice. It equips them with practical skills, industry insights, and networking opportunities crucial for career advancement in the field of structural engineering.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Objectives:

1 To provide students with practical, hands-on experience in a professional setting related to structural engineering.

2 Gain industry-specific skills, apply theoretical knowledge to real-world projects, and develop professional competencies.

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

CO 1 Acquire technical skills relevant to structural analysis, design, and project management.

CO 2 Enhance communication, teamwork, and problem-solving skills essential for a career in structural engineering.

CO 3 Gain insights into industry practices, standards, and regulations in structural engineering.

Course Outline

1 Students complete their industrial training during a minimum period of 20 weeks and pass the training assessment to graduate.

2 The student needs to submit the progress report of every 4-week industrial training to his/her department coordinator in Soft Copy (by email).

3 The student needs to submit the Final Report to his/her department coordinator as both a Hard Copy and a Soft Copy.

4 All communications from the college before, during, and after the Internship will be sent by email. The student is fully responsible for checking his/her email regularly and will bear all consequences of failing to do so

5 Students are strictly advised to follow the organization's working hours and attendance system, as attendance will be taken into consideration in the Internship grade

6 The student needs to maintain a DIARY/ DAILY LOG

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches, and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

Internal Assessment

1 TERM WORK assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time.

2 Regular meetings with industry mentors and academic supervisors to monitor progress and provide guidance.

Semester End Exam (SEE) OE/POE

1 Completion of reports, presentations, or a final project summarizing internship experiences and achievements.

2 Assessment criteria may include supervisor evaluations, project deliverables, and reflective assessments by the student during external oral examination.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr /week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSERP301	Dissertation Phase I (by Research)	-	-	-	-	14	-

Course Code	Course Name	Evaluation Scheme (In Semester)		Semester End Exam (SEE) OE/POE		Total (Marks)
		Term Work	Min Pass	Marks	Min pass	
PSERP301	Dissertation Phase I (by Research)	200	40%	150	40%	150

Course Description: The Dissertation Phase I typically involves laying the groundwork for the research that will culminate in the final dissertation or thesis.

Course Objectives:

1 Apply theoretical knowledge to solve problems, analyze data, and draw informed conclusions.

2 Critically evaluate information, arguments, and methodologies presented in course materials, assignments, and projects.

4 Identify and define problems related to course topics, formulate solutions, and implement them effectively.

5 Present complex information clearly and logically to both peers and external examiners.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

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

CO 1	Evaluate the outcomes of implemented solutions and propose adjustments based on analysis and feedback.
CO 2	Present complex information clearly and logically to both peers and external examiners, demonstrating proficiency in academic and professional communication.
CO 3	Apply research methodologies and techniques to investigate and explore issues within the course discipline.
CO 4	Exhibit professionalism in interactions with peers, faculty, and external examiners, reflecting responsibility and respect for academic standards.
CO 5	Foster a commitment to continuous learning and professional development in alignment with industry demands and academic expectations

Course Outline

1	Identify a research topic within the field of Structural Engineering that aligns with personal interests, addresses a gap in existing literature, and contributes to the field.
2	Conduct a thorough literature review to understand the current state of research, formulate research questions or hypotheses, and develop a research proposal.
3	Identify key theories, methodologies, and findings from previous studies, critically evaluate their contributions, and synthesize information to guide the research design.
4	Determine appropriate research methods (e.g., experimental, analytical, numerical simulations), data collection techniques, sampling procedures, and ethical considerations.

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Internal Assessment

1 Present the proposal to a dissertation committee (DPC) or faculty members for evaluation, feedback, and approval before proceeding to Phase II.

2 TERM WORK assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time

Semester End Exam (SEE) OE/POE

1 Provide an opportunity for external examiners, who are typically experts in the field but not directly affiliated with the course or institution, to evaluate students' knowledge, understanding, and ability to articulate concepts.

2 Evaluate the quality, accuracy, and originality of assignments, projects, and research conducted during the term.

3 Evaluate students' ability to communicate effectively, both orally and in writing, including clarity, coherence, and organization of ideas.

SEMESTER IV

Curriculum Structure of M. Tech. Structural Engineering AY 2025-26)

Course Code	Course Name	Teaching Scheme (Hr /week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSEPR401	Dissertation Phase II	-	-	-	-	20	-

Course Code	Course Name	Evaluation Scheme (In Semester)		Semester End Exam (SEE) OE/POE		Total (Marks)
		Term Work	Min Pass	Marks	Min pass	
PSEPR401	Dissertation Phase II	350	40%	150	40%	500

Course Description: Dissertation Phase II represents the culmination of the research project initiated in Phase I.

Course Objectives:

1 Gather, analyze, and interpret data to address research questions or test hypotheses effectively.

2 Synthesize findings with relevant literature identified during the literature review in Phase I.

3 Demonstrate critical thinking skills to analyze complex problems and propose solutions based on research findings.

4 Effectively communicate research findings and conclusions through written dissertation chapters and oral presentations.

5 Demonstrate professionalism and ethical conduct in all aspects of research and academic writing.

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

CO 1	Employ statistical or qualitative analysis methods to derive meaningful conclusions from the data.
CO 2	Integrate new research findings with existing literature and theoretical frameworks.
CO 3	Identify limitations or gaps in the research and propose future directions for further investigation.
CO 4	Present research findings to academic audiences, including the dissertation defense before a committee.
CO 5	Maintain academic integrity in citing sources, handling data, and presenting findings.

Course Outline

1	Implement the research methodology defined in Phase I, including data collection, analysis, and interpretation.
2	Collect primary data through experiments, surveys, field studies, or other methods. Analyze data using appropriate statistical or analytical techniques to derive meaningful conclusions.
3	Compare and contrast research findings with relevant theories and studies identified during the literature review. Discuss how the new findings contribute to or challenge existing knowledge in the field.
4	Present and interpret findings clearly, highlighting key observations and trends. Discuss the significance of findings and their implications for theory, practice, or policy in Structural Engineering.
5	Write chapters detailing the introduction, literature review, methodology, results, discussion, and conclusion. Ensure clarity, coherence, and logical flow of information throughout the dissertation.

Internal Assessment

1 Assess the dissertation based on criteria such as originality, scholarly rigor, contribution to knowledge, clarity of presentation, and adherence to academic standards at regular intervals.

2 TERM WORK assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time.

Semester End Exam (SEE) OE/POE

1 Assessment criteria may include supervisor evaluations, project deliverables, and reflective assessments by the student during external oral examination.

2 Present a formal defense of the dissertation, discussing research methodology, findings, and conclusions.

3 Respond to questions and critiques from the dissertation committee to demonstrate mastery of the subject matter.

Course Code	Course Name	Teaching Scheme (Hr /week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
PSERP401	Dissertation Phase II (by Research)	-	-	-	-	20	-

Course Code	Course Name	Evaluation Scheme (In Semester)		Semester End Exam (SEE) OE/POE		Total (Marks)
		Term Work	Min Pass	Marks	Min pass	
PSERP401	Dissertation Phase II (by Research)	350	40%	150	40%	500

Course Description: The Dissertation Phase I typically involves laying the groundwork for the research that will culminate in the final dissertation or thesis.

Course Objectives:

1 Gather, analyze, and interpret data to address research questions or test hypotheses effectively.
2 Synthesize findings with relevant literature identified during the literature review in Phase I.
3 Demonstrate critical thinking skills to analyze complex problems and propose solutions based on research findings.
4 Effectively communicate research findings and conclusions through written dissertation chapters and oral presentations.
5 Demonstrate professionalism and ethical conduct in all aspects of research and academic writing.

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

CO 1 Employ statistical or qualitative analysis methods to derive meaningful conclusions from the data.
CO 2 Integrate new research findings with existing literature and theoretical frameworks.
CO 3 Identify limitations or gaps in the research and propose future directions for further investigation.
CO 4 Present research findings to academic audiences, including the dissertation defense before a committee.
CO 5 Maintain academic integrity in citing sources, handling data, and presenting findings.

Course Outline

1	Implement the research methodology defined in Phase I, including data collection, analysis, and interpretation.
2	Collect primary data through experiments, surveys, field studies, or other methods. Analyze data using appropriate statistical or analytical techniques to derive meaningful conclusions.
3	Compare and contrast research findings with relevant theories and studies identified during the literature review. Discuss how the new findings contribute to or challenge existing knowledge in the field.
4	Present and interpret findings clearly, highlighting key observations and trends. Discuss the significance of findings and their implications for theory, practice, or policy in Structural Engineering.
5	Write chapters detailing the introduction, literature review, methodology, results, discussion, and conclusion. Ensure clarity, coherence, and logical flow of information throughout the dissertation.

Internal Assessment

1	Assess the dissertation based on criteria such as originality, scholarly rigor, contribution to knowledge, clarity of presentation, and adherence to academic standards at regular intervals.
2	TERM WORK assessment must be based on the overall performance of the student, with every assignment done on a computer, graded from time to time.

Semester End Exam (SEE) OE/POE

1	Submit your manuscript to the selected journal for peer review. Respond to reviewer comments professionally and address concerns or suggestions for manuscript improvement.

2	Provide an opportunity for external examiners, who are typically experts in the field but not directly affiliated with the course or institution, to evaluate students' knowledge, understanding, and ability to articulate concepts.
3	Evaluate the quality, accuracy, and originality of assignments, projects, and research conducted during the term.
4	Evaluate students' ability to communicate effectively, both orally and in writing, including clarity, coherence, and organization of ideas.

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