Shree Warana Vibhag Shikshan Mandal's

WARANA UNIVERSITY,
WARANANAGAR

(A State Public University established under Section 3 (6) of MPUA, 2016)

॥ विद्या सर्वस्य भूषणम् ॥

Warana University

Established: 2025

Structure & Syllabus

of

First Year Master of Technology (M. Tech.)

In

Structural Engineering

Department of Civil Engineering

Under

Faculty of Science & Technology

Structure and Syllabus in Accordance With

National Education Policy - 2020

With Effective from Academic Year 2025-26

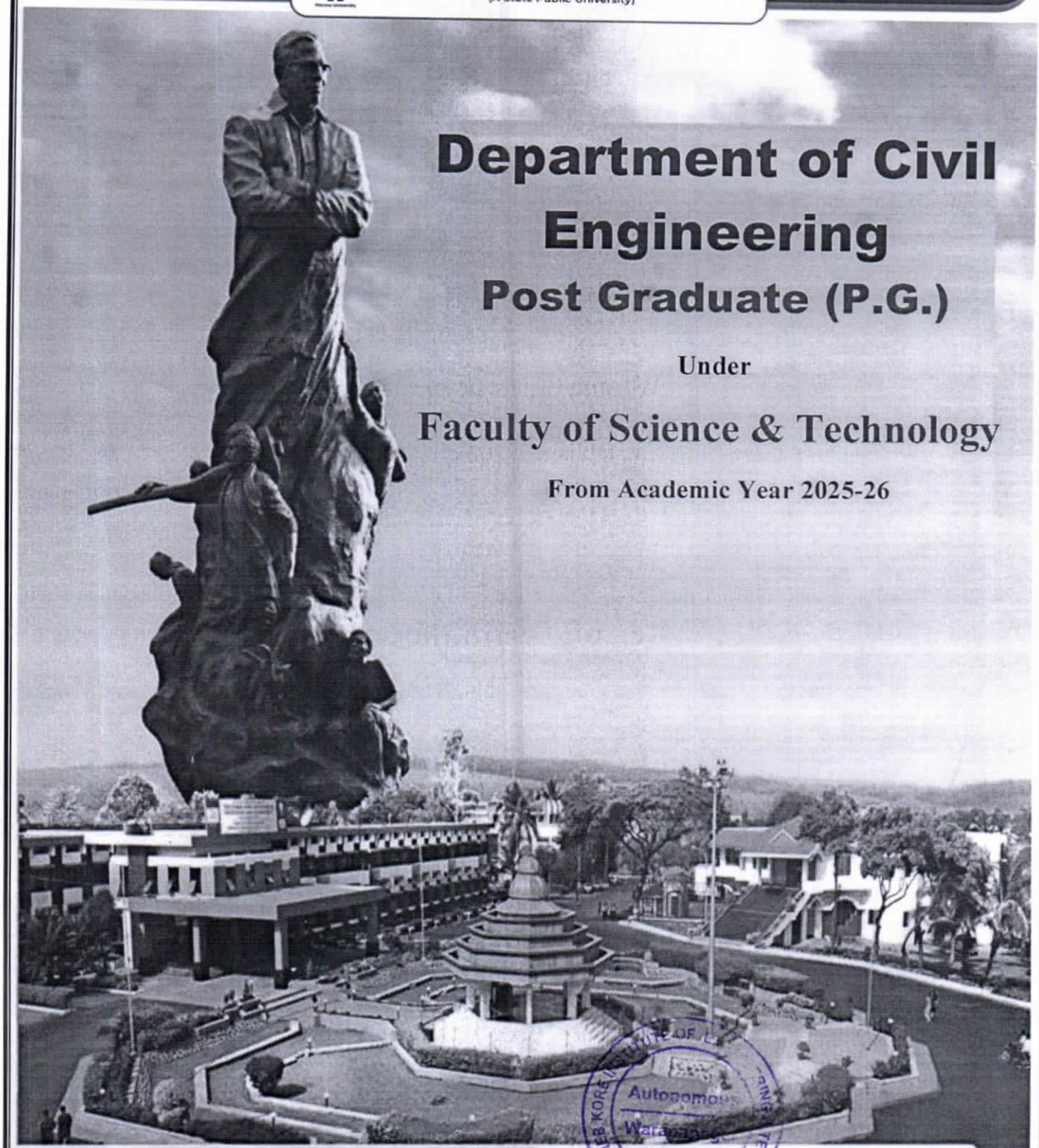
Shree Warana Vibhag Shikshan Mandal's

TATYASAHEB KORE INSTITUTE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS), WARANANAGAR, KOLHAPUR

TKIET
Estd. 1983

Lead Institute of

WARANA UNIVERSITY, WARANANAGAR
(A State Public University)



Department of Civil Engineering

Post Graduate (P.G.)

Under

Faculty of Science & Technology

From Academic Year 2025-26

M. Tech. in Structural Engineering

Structure and Syllabus under Autonomy as per NEP Policy 2020

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

M. Tech. Civil (Structural Engineering)

AS per NEP 2020

(To be implemented from 2025-26)

Abbreviations

Sr. No	Acronym	Definition
1	ISE	In-Semester Examination
2	ISE -I	In-Semester Examination I
3	ISE-II	In-Semester Examination II
4	ESE	End Semester Examination
5	TH	Theory Lecture
6	Tut	Tutorial
7	P	Practical
8	O	Oral
9	TW	Term Work
10	CH	Contact Hours
11	C	Credit

Course/ Subjects Categories

Sr. No	Acronym	Definition
1	PCC	Professional Core Course
2	PE	Program Elective
3	OE	Open Elective Course
4	LC	Laboratory Course
5	MC	Mandatory Course
6	SW	Seminar work
7	II	Industrial Internship
8	PC	Dissertation
9	SLC/AC	Self-Learning Course/Audit course

CO, PO & PSO Mapping Correlation:

Low	Medium (Moderate)	High (Substantial)
1	2	3

Course/ Subject Code

P	1	0	1
Branch Code	Semester	Course Number	

Course Term work and POE Code

P	5	0	1	T / P / A
Branch Code	Semester	Course Number		T Tutorial P POE A Audit Course

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

M. Tech. Civil (Structural Engineering)

AS per NEP 2020

(To be implemented from 2025-26)

Vision

To become an academy of excellence in technical education and humanresource development.

Mission

- To develop engineering graduates of high repute with professional ethics.
- To excel in academics and research through innovative techniques.
- To facilitate the employability, entrepreneurship along with social responsibility.
- To collaborate with industries and institutes of national recognition.
- To inculcate lifelong learning and respect for the environment.

Quality Policy

To promote excellence in academic and training activities by inspiring students for becoming competent professionals to cater industrial and social needs.

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

M. Tech. Civil (Structural Engineering)

AS per NEP 2020

(To be implemented from 2025-26)

Department of Civil Engineering

Program Educational Objectives (PEO's)

After completion of program, Post Graduates will be able to

1	**PEO1:** Demonstrate advanced knowledge in structural engineering concepts, design methodologies, and material behavior for reinforced and prestressed concrete, steel, and composite structures
2	**PEO2:** Apply analytical, computational, and experimental techniques to model, analyze, and design complex structural systems considering safety, durability, and serviceability.
3	**PEO3:** Develop innovative and sustainable solutions for structural engineering problems, including retrofitting, rehabilitation, and disaster-resistant design
4	**PEO4:** Engage in professional practice, research, and lifelong learning, effectively communicating ideas and leading multidisciplinary teams in academic, industrial, and construction environments.

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY
Autonomous
Warananagar

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

M. Tech. Civil (Structural Engineering)

AS per NEP 2020

(To be implemented from 2025-26)

Department of Civil Engineering

Program Outcomes (PO's)

After completion of program, Post Graduates will be able to

PO1	**Demonstrate** knowledge in mathematics, basic sciences & civil engineering
PO2	**Identify**, formulate and solve civil engineering problems.
PO3	**Prepare** structural design such that fulfills design specification, durability, economy & safety.
PO4	**Design** and conduct experiment, analyze data & also interpret result to provide conclusion.
PO5	**Use** appropriate engineering techniques & software tools to analyze civil engineering problems.
PO6	**Apply** civil engineering knowledge for construction site in all respect like planning, execution and supervision.
PO7	**Sensitive** towards ethical, societal & environmental issue along with professional work.
PO8	**Exhibit** understanding of professional & ethical responsibility.
PO9	**Ability** to function as a leader of multidisciplinary team.
PO10	**Communicate** effectively in both verbal & written form.
PO11	**Develop** engineering research ability & project management skill.
PO12	**Possess** confidence for self-education & ability for lifelong learning.

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

M. Tech. Civil (Structural Engineering)

AS per NEP 2020

(Implemented from 2025-26)

Program Specific Outcomes (PSO's)

After completion of program, Post Graduates will be able to

1	**PSO1:** Apply advanced concepts of structural analysis, design, and material science to develop safe, durable, and sustainable structures as per national and international codes
2	**PSO2:** Utilize modern computational tools, finite element methods, and experimental techniques to model, analyze, and design complex structural systems under static, dynamic, wind, and seismic loads.
3	**PSO3:** Demonstrate research aptitude and innovative thinking in solving real-life structural engineering problems, with emphasis on sustainability, retrofitting, and disaster resilience.

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY ★ Autonomous Warananagar

First Year M. Tech. Civil (Structural Engineering)

Curriculum Structure and Evaluation Scheme

Semester-I

Sr. No.	Category	Course Category	Course Code	Course Title	Teaching and Credit Scheme					Examination and Evaluation Scheme			
					L	T	P	C	CH	Component	Marks	Min. for Passing	
1	Programme Course	PCC	2501PCST PCC101	Mechanics of Structures	3	-	-	3	3	ESE	60	24	40
										ISE	40	16	
			2501PCST PCC101T	Mechanics of Structures (Tutorial)	-	1	-	1	1	ISA	25	10	10
			2501PCST PCC102	Structural Dynamics & Earthquake Engineering	3	-	-	3	3	ESE	60	24	40
										ISE	40	16	
			2501PCST PCC102T	Structural Dynamics & Earthquake Engineering (Tutorial)	-	1	-	1	1	ISA	25	10	10
2	Program Elective	PE	2501PCST PE103X	Program Elective-I	3	-	-	3	3	ESE	60	24	40
										ISE	40	16	
			2501PCST PE104X	Program Elective-II	3	-	-	3	3	ESE	60	24	
										ISE	40	16	
			2501PCST PE105X	Program Elective-III	3	-	-	3	3	ESE	60	24	40
										ISE	40	16	
3	Laboratory Course	LC	2501PCST LC106P	Laboratory Practice	-	-	4	2	4	OE	25	10	20
										ISA	25	10	
4	Seminar Work	SW	2501PCST SW107T	Seminar-I	-	-	2	1	2	ISA	50	20	20
					15	**2**	**6**	**20**	**23**	--	**650**	**260**	**260**

Note: 'X' indicates the sequence number of Program Elective (PE) offered by Mechanical (Design Engineering) Program.

First Year M. Tech. Mechanical Civil (Structural Engineering)

Curriculum Structure and Evaluation Scheme

Semester-II

Sr. No.	Category	Course Category	Course Code	Course Title	Teaching and Credit Scheme					Examination and Evaluation Scheme			
					L	T	P	C	CH	Component	Marks	Min. for Passing	
1	Programme Course	PCC	2501PCST PCC201	Theory of Elasticity and Plasticity	3	--	--	3	3	ESE	60	24	40
										ISE	40	16	
		PCC	2501PCST PCC201T	Theory of Elasticity and Plasticity (Tutorial)	--	1	--	1	1	ISA	25	10	10
		PCC	2501PCST PCC202	Finite Element Methods	3	--	--	3	3	ESE	60	24	40
										ISE	40	16	
		PCC	2501PCST PCC202T	Finite Element Methods (Tutorial)	--	1	---	1	1	ISA	25	10	10
2	Program Elective	PE	2501PCST PE203X	Program Elective-IV	3	--	--	3	3	ESE	60	24	40
										ISE	40	16	
		PE	2501PCST PE204X	Program Elective-V	3	--	--	3	3	ESE	60	24	40
										ISE	40	16	
3	Open Elective Course	OE	2501PCST OE205X	Open Elective Course	3	--	--	3	3	ESE	60	24	40
										ISE	40	16	
4	Laboratory Course	LC	2501PCST LC206P	Structural Design Lab	--	--	4	2	4	ISA	25	10	10
					--	1	--	1	1	OE	25	10	10
5	Seminar Work	SW	2501PCST SW207T	Seminar-II	--	--	2	1	2	ISA	50	10	10
					15	3	6	21	24	--	650	250	250

Note:

- 'X' indicates the sequence number of Program Elective (PE) offered by Mechanical (Design Engineering) Program.
- Students should opt for the Open Elective (OE) course from other departments. The list of OE courses offered by other departments is available in the structure. Although the OE course code is defined by the respective program in the structure, the actual opted OE course will appear on the mark card.

First Year M. Tech. Civil (Structural Engineering)

List of Program Elective (PE)

Semester-I

	Course Code	Course Title
Program Elective-I	2501PCSTPE1031	Advance Design of Concrete Structures
	2501PCSTPE1032	Advances in Concrete Composite
	2501PCSTPE1033	Advanced Design of Prestressed Concrete Structures
Program Elective-II	2501PCSTPE1041	Design of RC Bridges
	2501PCSTPE1042	Structural Health Monitoring
	2501PCSTPE1043	Repairs and Rehabilitations of Structures
Program Elective-III	2501PCSTPE1051	Advanced Structural Analysis
	2501PCSTE1052	Stability of Structures
	2501PCSTPE1053	Dynamics of Structure

Semester-II

	Course Code	Course Title
Program Elective-IV	2501PCSTPE2031	Advanced Design of Structural Foundations
	2501PCSTPE2032	Theory of Plates and Shells
	2501PCSTPE2033	Advanced Design of Reinforced Concrete Structures
Program Elective-V	2501PCSTPE2041	Advanced Design of Steel Structures
	2501PCSTPE2042	Soil Structure Interaction
	2501PCSTPE2043	Design of High-Rise Buildings

First Year M. Tech. Civil (Structural Engineering)

List of Open Electives (OE) Courses

Sr. No.	OE Offered by Program	Course Code	Open Elective Course
1	Chemical Engineering	2501PCHEOE2051	Project Management
2		2501PCHEOE2052	Operations Research
3		2501PCHEOE2053	Energy Technology
4	Electronics & Telecommunication Engineering	2501PETCOE2051	Advanced Operating Systems
5		2501PETCOE2052	Cyber Security
6		2501PETCOE2053	Artificial Intelligence and Machine Learning
7	Construction Management (Civil Engineering)	2501PCCMOE2051	Water Power Engineering
8		2501PCCMOE2052	Waste to Energy
9		2501PCCMOE2053	Contracts & Tenders
10	Mechanical Design (Mechanical Engineering)	2501PMDEOE2051	Cryogenics
11		2501PMDEOE2052	Design for Manufacture & Assembly
12		2501PMDEOE2053	Enterprise Resource Planning
13	Structural Engineering (Civil Engineering)	2501PCSTOE2051	Cost Management of Engineering Projects
14		2501PCSTOE2052	Optimization Techniques in Civil Engineering
15		2501PCSTOE2053	Industrial Safety
16	Computer Science and Engineering	2501PCSEOE2051	Ethical AI & Explainability
17		2501PCSEOE2052	Computer Vision
18		2501PCSEOE2053	High Performance Computing for Multidisciplinary Research

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY
Autonomous
Warananagar

M Tech (Structure)

First Year

Semester-I

Syllabus of Course offered

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPCC101: Mechanics of Structures

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	01 Hrs./Week	**ESE**	60 Marks
Total Credits	04	**TW**	25 Marks
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To develop advanced understanding of influence lines, beam-columns, and analysis of determinate and indeterminate structures
2. To apply stiffness and flexibility methods for analysis of continuous beams, trusses, frames, and curved beams.
3. To integrate computational techniques for structural analysis using matrix and member-oriented stiffness methods.
4. To prepare students for research, practical problem-solving, and design of complex structures under varied loading conditions

	Course Contents	Hours
Unit 1	**Influence Lines and Moment Distribution** Influence Line Diagrams for Indeterminate Structures: Continuous beams, portal frames & two hinged arches. Muller-Breslau's Principle & Moment distribution method	(08)
Unit 2	**Curved Beams** Beams Curved in Plan: Determinate & Indeterminate beams curved in plan.	(08)
Unit 3	**Beams on Elastic Foundations** Beams on Elastic Foundations: Analysis or infinite, semi-infinite & finite beam	(06)
Unit 4	**Beam columns:** Concept of geometric & material nonlinearity. Governing differential equation, Analysis of beam-columns subjected to different loadings and support conditions. Stiffness and carry-over factors for beam-columns, fixed end actions due to various loads.	(06)
Unit 5	**Stiffness Method – Structure Oriented** Stiffness method of structural analysis, flexibility and stiffness matrices, Analysis of continuous beams, trusses and plane frames by Structure oriented stiffness approach.	(06)
Unit 6	**Member Oriented Stiffness Method:** Stiffness matrices of beam, truss, plane frame grid, pin & rigid jointed space frame elements on member axes. Transformation of matrices on Structure axes. Over- all joint stiffness matrix and nodal load vector, assembly rules. Calculation of member end forces, Bandwidth.	(06)

	Course Outcomes (CO): At the end of course, students will able to
1	Draw and interpret influence line diagrams for continuous beams, portal frames, and two-hinged arches
2	Analyze determinate and indeterminate curved beams subjected to various loads.
3	Solve beam-on-elastic-foundation problems for infinite, semi-infinite, and finite beams.
4	Analyze beam-columns considering geometric and material nonlinearity under different support conditions.
5	Apply structure-oriented stiffness method to analyze continuous beams, trusses, and plane frames.
6	Utilize member-oriented stiffness method frames, including transformation and assembly of stiffness matrices.

	Text Books
1	Elements of Strength of Materials – Timoshenko and Young, East-West Press.
2	Intermediate Structural Analysis – Wang C.K., McGraw Hill Education
3	Mechanics of Materials – Gere and Timoshenko, PWS Publishing Company.
5	Structural Analysis – Vol I and II – S.S. Bhavikatti, Vikas Publishing House.
6	Theory of Structures – S. Ramamrutham, Dhanpat Rai Publishing Company.

	Reference Books
1	Advanced Mechanics of Solids – L.S. Srinath, McGraw Hill Education.
2	Theory and Analysis of Elastic Plates and Shells – J.N. Reddy, CRC Press
3	Theory of Elasticity – S.P. Timoshenko and J.N. Goodier, McGraw Hill Education
4	Advanced Structural Analysis – Devdas Menon, Narosa Publishing House
5	Solid Mechanics – Kazimi S.M.A., Tata McGraw Hill Publishing Co. Ltd.
6	Analysis of Structures – Vol I & II – Vazirani and Ratwani, Khanna Publishers.

	Useful Websites
1	https://nptel.ac.in – Lectures on advanced structural analysis, stiffness & flexibility methods
2	https://theconstructor.org – Examples and solved problems on indeterminate structures.
3	https://ascelibrary.org – Research papers on matrix analysis and structural mechanics.
4	https://sciencedirect.com – Articles on beam-columns, curved beams, and elastic foundation problems.
5	https://structurae.net – Case studies and database for continuous beams, portal frames, and arches

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	-	-	1	3	2	3
CO2	3	3	3	2	2	2	-	-	1	3	2	3
CO3	3	3	3	2	2	2	-	-	1	3	2	3
CO4	3	3	3	3	3	2	2	-	2	3	3	3
CO5	3	3	3	3	3	2	2	-	2	3	3	3
CO6	3	3	3	3	3	2	2	-	2	3	3	3

Term Work: The term work part should include one assignment on each unit including problems (If any)

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPCC102: Structural Dynamics and Earthquake Engineering

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	01 Hrs./Week	**ESE**	60 Marks
Total Credits	04	**TW**	25 Marks
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Understand dynamic behavior of structures and the effects of various types of loading including seismic.
2. Formulate and solve differential equations governing single and multi-degree freedom systems.
3. Analyze structural response to earthquakes using different methods.
4. Learn design philosophies and codal provisions for earthquake-resistant structures.

	Course Contents	Hours
Unit 1	**Fundamentals of Structural Dynamics** Difference between static and dynamic loading, Types of dynamic loads, Equation of motion for SDOF systems, D'Alembert's principle, Free and forced vibration (with and without damping), Response to harmonic, periodic and impulsive loads	(08)
Unit 2	**Multi-Degree Freedom Systems** Equation of motion for MDOF systems, Matrix formulation, Eigenvalue problem, Natural frequencies and mode shapes, Modal superposition method, Orthogonality of modes	(08)
Unit 3	**Continuous Systems** Introduction to dynamics of continuous systems, Vibrations of strings, bars and beams, Longitudinal and transverse vibration, Application of Rayleigh and Rayleigh-Ritz methods	(06)
Unit 4	**Earthquake Ground Motion and Response** Seismic waves and strong ground motion, Characteristics of ground motion, Response spectrum, Construction and interpretation of response spectra, Concept of seismic zoning	(06)
Unit 5	**Seismic Analysis of Structures** Idealization of structures, Linear and nonlinear behaviour, Response history and modal analysis, Time history and frequency domain analysis, Equivalent static analysis and response spectrum method (IS 1893)	(06)
Unit 6	**Earthquake Resistant Design** Ductility, overstrength, and redundancy, Codal provisions (IS 1893, IS 13920), Design of RC and steel structures, Base isolation and energy dissipation systems, Performance-based design concepts	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Understand the behavior of structures subjected to dynamic loading
2	Analyze SDOF and MDOF systems for free and forced vibration

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY Autonomous Warananagar

3	Apply principles of vibration to continuous structural elements
4	Interpret and construct response spectra for earthquake ground motions.
5	Perform seismic analysis using IS codes and advanced methods
6	Apply codal provisions to design earthquake-resistant structures effectively.

Text Books	
1	Dynamics of Structures – Theory and Applications to Earthquake Engineering – Anil K. Chopra, *Pearson*
2	Structural Dynamics – Mario Paz and William Leigh, Springer.
3	Earthquake Resistant Design of Structures – Pankaj Agarwal and Manish Shrikhande, *PHI Learning*
4	Structural Dynamics – Theory and Computation – Mario Paz, *Springer*
5	Structural Dynamics: Vibrations and Systems – Madhujit Mukhopadhyay, *Ane Books Pvt. Ltd*
6	Vibration Problems in Engineering – S.P. Timoshenko, D.H. Young and W. Weaver, *John Wiley & Sons*

Reference Books	
1	Earthquake Engineering for Structural Design – W.H. Robinson and D.J. Dowrick, *Oxford*
2	Structural Dynamics: Concepts and Applications – Joseph W. Tedesco, William G. McDougal, C. Allen Ross, *Pearson Education*
3	Introduction to Structural Dynamics and Aeroelasticity – Dewey H. Hodges and G. Alvin Pierce, *Cambridge University Press.*
4	Fundamentals of Structural Dynamics – Roy R. Craig Jr., Andrew J. Kurdila, *John Wiley & Sons*
5	Earthquake Engineering: From Engineering Seismology to Performance-Based Engineering – Yousef Bozorgnia and Vitelmo V. Bertero, *CRC Press*
6	Seismic Design of Reinforced Concrete and Masonry Buildings – T. Paulay and M.J.N. Priestley, *John Wiley & Son*

Useful Websites	
1	https://nptel.ac.in – NPTEL video lectures on Structural Dynamics and Earthquake Engineering
2	https://www.eqclearinghouse.org – Earthquake Engineering Research Institute (EERI) resources
3	https://www.iitk.ac.in/nicee – National Information Center of Earthquake Engineering (NICEE)
4	https://www.usgs.gov – U.S. Geological Survey for seismic data
5	https://ascelibrary.org – ASCE Library for latest earthquake engineering research

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	1	–	1	–	1	2	1
CO2	3	2	3	3	2	–	–	–	–	1	2	–
CO3	3	2	3	3	2	2	–	–	–	1	2	1
CO4	3	1	3	3	2	–	–	–	–	1	2	–
CO5	3	2	3	3	3	2	1	1	1	1	2	1
CO6	3	2	3	3	3	2	2	1	1	1	2	1

Term Work: The term work part should include one assignment on each unit including problems (If any)

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPE1031: Advanced Design of Concrete Structures

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	---	**ESE**	60 Marks
Total Credits	03	**TW**	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Develop an advanced understanding of analysis and design principles of special reinforced concrete elements.
2. Provide knowledge of the design of foundations, water retaining structures, and staging systems under various loading conditions.
3. Introduce the fundamental concepts, mechanics, and design methodologies of prestressed concrete.
4. Equip students with the ability to analyze, design, and evaluate prestressed concrete members and special structural sections as per IS codes.

	Course Contents	Hours
Unit 1	**Analysis and Design of Special Slabs** Design of flat slab, grid slab, circular slab.	(08)
Unit 2	**Design of Footings & Rafts** Analysis and design of combined footing & raft foundation	(08)
Unit 3	**Analysis and Design of Water Tanks & Staging** Analysis and design of overhead water tank – Rectangular & circular with flat bottom Design of staging for wind & seismic loads	(06)
Unit 4	**Mechanics of Prestressed Concrete** Mechanics of pre-stressed concrete, stress concept, strength concept & load balancing concept, high strength material, systems of prestressing, losses of prestress.	(06)
Unit 5	**Design of Prestressed Concrete Members** Design of Prestressed Concrete, beams, box, T& I Sections, Shear, Deflection, Design of End Block, IS code method.	(06)
Unit 6	**Analysis and Design of Special Prestressed Sections** Analysis & design of continuous beams, partial prestressing, circular prestressing – pipes.	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Analyze and design flat slabs, grid slabs, and circular slabs using advanced methods.
2	Design combined footings and raft foundations considering soil–structure interaction
3	Analyze and design overhead water tanks and staging under wind and seismic loads.
4	Explain stress, strength, load balancing concepts and evaluate prestress losses.

5	Design prestressed concrete beams, box, T & I sections, shear, deflection and end blocks as per IS codes.
6	Apply advanced concepts to design continuous beams, partially prestressed members, and circular prestressed pipes.

	Text Books
1	Advanced Reinforced Concrete Design – P.C. Varghese, 2nd Edition, Prentice Hall of India, 2012.
2	Design of Reinforced Concrete Structures – N. Subramanian, Oxford University Press, 2014.
3	Limit State Design of Reinforced Concrete – P. Dayaratnam, 3rd Edition, Oxford & IBH Publishing, 2013.
4	Prestressed Concrete – N. Krishna Raju, 5th Edition, Tata McGraw Hill Education, 2012.
5	Prestressed Concrete Structures – P. Dayaratnam & R. Narayan, Oxford & IBH Publishing, 2011.
6	Design of Reinforced Concrete Structures – S. Ramamrutham & R. Narayan, 16th Edition, Dhanpat Rai Publications, 2018
	Reference Books
1	Reinforced Concrete Design – S. Unnikrishnan Pillai & Devdas Menon, 4th Edition, Tata McGraw Hill,2017
2	Design of Concrete Structures – Arthur H. Nilson, David Darwin & Charles W. Dolan, 14th Edition, McGraw Hill International Edition, 2010.
3	Structural Design of Tall Buildings – Bungale S. Taranath, 2nd Edition, McGraw Hill, 2011
4	Prestressed Concrete Analysis and Design – M.K. Hurst, 2nd Edition, CRC Press, 2017.
5	Fundamentals of Prestressed Concrete – Y. Guyon, Contractors Record Ltd., London, Reprint 2010.
6	Design of Prestressed Concrete Structures – T.Y. Lin and Ned H. Burns, 3rd Edition, John Wiley & Sons, 1991.
	Useful Websites
1	https://nptel.ac.in/courses/105101087– NPTEL lectures on Design of Reinforced Concrete Structures (IIT Madras)
2	https://nptel.ac.in/courses/105106118– NPTEL lectures on Prestressed Concrete Structures (IIT Madras)
3	https://www.services.bis.gov.in – Bureau of Indian Standards (IS 456, IS 1343, IS 3370, IS 875, IS 1893 etc.)
4	https://icidcbc.org – Indian Concrete Institute (ICI) for journals, technical papers, and concrete design resources
5	https://structville.com – Struct Ville articles and solved examples on advanced reinforced and prestressed concrete design

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	2	-	-	-	1	2	2
CO2	3	3	3	2	2	2	-	-	-	1	2	2
CO3	3	3	3	2	2	3	-	-	-	2	2	2
CO4	3	2	2	2	2	1	-	-	-	1	2	2
CO5	3	3	3	2	3	2	-	-	-	2	2	2
CO6	3	3	3	2	3	2	-	-	-	2	2	2

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering)
Semester- I

2501PCSTPE1032: Advances in Concrete Composite

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Understand the properties, types, and applications of fiber reinforced, ferrocement, silica fume, and polymer concrete
2. Evaluate the fresh and hardened properties of advanced concrete materials using standard tests
3. Analyze and design concrete structures incorporating fibers, ferrocement, and polymer-based materials.
4. Develop skills for selecting and applying advanced concrete materials in sustainable and durable structural solutions.

	Course Contents	Hours
Unit 1	**Fiber Reinforced Concrete** Fiber reinforced composites: Introduction to Fiber Reinforced Concrete, types of fibres, properties of fibres. Properties of constituent materials. Mix proportion, fixing, casting.	(08)
Unit 2	**Properties of Fresh and Hardened Fiber Concrete** Properties of freshly mixed reinforced concrete (fibre concrete), workability tests, mechanical properties, Mechanics and mechanism of Fiber Reinforced Concrete.	(08)
Unit 3	**Testing and Design of Fiber Reinforced Concrete** Testing of fibre reinforced under compression, flexure, and shear and bending. Various toughness indices. Stress-strain behaviour. Design aspects of reinforced concrete structures with fibres.	(06)
Unit 4	**Ferrocement: Materials, Construction, and Design** Ferro cement - Introduction, materials used mechanical properties, construction techniques, design in direct tension, and applications merits as structural materials.	(06)
Unit 5	**Silica Fume Concrete: Properties and Durability** Silica Fume Concrete - Introduction, physical and chemical properties of silica physical and chemical properties of silica fume concrete in fresh state, mechanical properties and durability of silica concrete.	(06)
Unit 6	**Polymer Concrete: Types, Properties, and Applications** Polymer Concrete: Introduction, Classification, properties of constituent materials, polymer impregnated concrete, polymer concrete, application	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Explain the types, properties, and applications of fibers in fiber reinforced concrete.
2	Evaluate the fresh and hardened properties of fiber reinforced concrete using standard tests.

3	Analyze and design fiber reinforced concrete members under compression, flexure, and shear.
4	Understand ferrocement materials, mechanical properties, construction techniques, and design applications.
5	Examine the properties, mechanical performance, and durability aspects of silica fume concrete
6	Describe polymer concrete, polymer impregnated concrete, and their structural applications.

Text Books

1	**Fiber Reinforced Cement Composites** – P. K. Mehta & Paulo J. M. Monteiro, 2nd Edition, McGraw Hill Education, 2014.
2	**Fiber Reinforced Concrete: Properties and Applications** – M. R. K. Rao, 1st Edition, Alpha Science International, 2012.
3	**Ferrocement and Laminated Cementitious Composites** – P. S. R. Prasad, 1st Edition, CRC Press, 2010.
4	**High Performance Concrete** – P. Kumar Mehta, 2nd Edition, McGraw Hill, 2013.
5	**Polymer Concrete: Structure and Applications** – R. N. Swamy, 1st Edition, Elsevier, 2003.
6	**Concrete Technology: Theory and Practice** – M. L. Gambhir, 6th Edition, McGraw Hill Education, 2015.

Reference Books

1	**Properties of Concrete** – A. M. Neville, 5th Edition, Pearson Education, 2012.
2	**Fiber Reinforced Concrete: An Overview** – P. K. Mehta & Paulo J. M. Monteiro, 2nd Edition, Prentice Hall, 2014.
3	**Ferrocement: Properties, Construction and Applications** – P. S. R. Prasad, CRC Press, 2011.
4	**High Strength Concrete: Materials and Technology** – F. H. Wittmann, 2nd Edition, E & FN Spon, 2008
5	**Polymer Modified Concrete** – V. M. Malhotra, 1st Edition, CRC Press, 2005.
6	**Advanced Concrete Technology** – John Newman & Ban Seng Choo, 1st Edition, Elsevier, 2003.

Useful Websites

1	https://nptel.ac.in/courses/105101087– NPTEL lectures on concrete technology and fiber reinforced concrete
2	https://www.services.bis.gov.in – BIS portal for Indian standards related to fiber concrete, silica fume, and polymer
3	https://icidcbc.org – Indian Concrete Institute for research papers, journals, and technical reports
4	https://www.concrete.org – American Concrete Institute (ACI) for technical resources on advanced concrete materials
5	https://structville.com – Struct Ville blog for practical insights, solved examples, and design applications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	1	2	1	1	1	2
CO2	3	3	3	2	2	2	1	1	1	2	2	2
CO3	3	3	3	2	3	2	1	1	1	2	2	2
CO4	3	2	2	2	2	2	2	2	1	1	2	2
CO5	3	3	3	2	2	2	1	1	1	2	2	2
CO6	3	2	2	2	2	2	1	1	1	2	2	2

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPE1033: Advanced Design of Prestressed Concrete Structures

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	---	**ESE**	60 Marks
Total Credits	03	**TW**	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Introduce the fundamental principles, types, systems, and material requirements of prestressed concrete.
2. Develop analytical and design skills for prestressed flexural members, beams, slabs, and indeterminate structures as per codal provisions
3. Enable students to apply design methodologies for anchorage zones, composite construction, pipes, and columns considering serviceability and ultimate limit states.
4. Foster understanding of advanced topics such as partial prestressing, creep, shrinkage, and crack width control for practical applications.

	Course Contents	Hours
Unit 1	**Introduction to prestressed concrete**: types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions	(08)
Unit 2	**Statically determinate PSC beams:** design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.	(08)
Unit 3	**Transmission of prestressing pretensioned members:** Anchorage zone stresses for posttensioned members.	(06)
Unit 4	**Statically indeterminate structures:** Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordance.	(06)
Unit 5	**Composite construction** with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack width calculations	(06)
Unit 6	**Analysis and design** of prestressed concrete pipes, columns with moments.	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Explain the principles of prestressing, types, devices, and analyze losses in prestress.
2	Analyze and design statically determinate prestressed beams for flexure, shear, torsion as per IS Code
3	Evaluate transmission and anchorage zone stresses in pretensioned and post-tensioned members.
4	Analyze and design statically indeterminate prestressed concrete structures including continuous beams and frames.

5	Apply concepts of composite construction, creep, shrinkage, partial prestressing, and crack width calculations in design.
6	Design special prestressed concrete elements such as pipes and columns under axial load and moments.

	Text Books
1	Prestressed Concrete – N. Krishna Raju, Tata McGraw-Hill, 6th Edition, 2018.
2	Prestressed Concrete Structures – P. Dayaratnam & P. Sarah, Oxford & IBH, 7th Edition, 2017.
3	Design of Prestressed Concrete Structures – T.Y. Lin & Ned H. Burns, Wiley, 3rd Edition, 1981.
4	Limit State Design of Prestressed Concrete – Y. Guyon, Applied Science Publishers, 1972.
5	Prestressed Concrete – N. Rajagopalan, Narosa Publishing House, 2002.
6	IRC:112 – Code of Practice for Concrete Road Bridges (Prestressed/RC), Indian Roads Congress, 2011.

	Reference Books
1	Prestressed Concrete: Design and Construction – Fritz Leonhardt, Wilhelm Ernst & Sohn, 1977.
2	Prestressed Concrete Structures – Collins & Mitchell, Prentice Hall, 1991.
3	Design of Prestressed Concrete – Arthur H. Nilson, John Wiley & Sons, 2nd Edition, 1987
4	Design of Prestressed Concrete to AS3600 – Gilbert & Mickleburgh, Longman, 1988.
5	Design of Prestressed Concrete to AS3600-2009 – R.I. Gilbert, N.C. Mickleburgh, G. Ranzi, CRC Press, 2016.
6	IS:1343 – Code of Practice for Prestressed Concrete, Bureau of Indian Standards, 2012 (Reaffirmed).

	Useful Websites
1	NPTEL – Prestressed Concrete Structures: https://nptel.ac.in
2	BIS Standards (IS Codes Online): https://www.services.bis.gov.in
3	Engineering Civil Resource Hub: https://www.engineeringcivil.com
4	Concrete Centre (UK): https://www.concretecentre.com
5	ScienceDirect – Prestressed Concrete Research Papers: https://www.sciencedirect.com

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	1	-	-	1	1	2
CO2	3	3	3	2	3	2	1	1	-	1	1	2
CO3	2	2	3	3	3	2	1	1	-	1	1	1
CO4	3	3	3	2	3	2	1	1	1	2	2	2
CO5	2	2	3	2	2	2	2	1	-	1	2	2
CO6	3	3	3	2	3	2	1	1	-	1	2	2

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPE1041: Design of RC Bridges

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Understand the fundamental concepts, forms, and types of bridges along with selection criteria and foundations
2. Learn about various design loads, forces, and their impact on bridge structural systems as per IRC codes
3. Develop the ability to design different types of R.C.C. bridge decks, substructures, and special components.
4. Gain knowledge of construction techniques, erection methods, bearings, expansion joints, and bridge maintenance practices.

	Course Contents	Hours
Unit 1	**Introduction to Bridges** General Basic bridge forms –beam, arch, suspension, various types of bridges, selection of type of Bridge and economic span length, super structure - philosophy, geometric alignment, drainage, road curb, wall foundation, pile foundation, open well foundation.	(08)
Unit 2	**Design Loads and Forces on Bridges** loads for bridges –dead load, vertical live load, IRC loading, wind load, longitudinal forces, centrifugal forces, buoyancy, water current forces, thermal forces, deformation and horizontal forces.	(08)
Unit 3	**Design of R.C.C. Bridge Decks** Design of R. C. deck slab, beam and slab, T beam, Pigeaud's theory, Courbon's theory, balanced cantilever bridge, box culvert.	(06)
Unit 4	**Construction Techniques, Inspection, Maintenance, and Repair of Bridges** Construction techniques -construction of sub structure footing, piles, caissons, construction of reinforced earth retaining wall and reinforced earth abutments, super structure erection method bridge deck construction, by cantilever method, Inspection maintenance and repair of bridges.	(06)
Unit 5	**Design of Bridge Substructures** Analysis and design of sub structure abutments, Piers, approach slab.	(06)
Unit 6	**Bridge Bearings and Expansion Joints** Bearing and expansion joints forces on bearings Types of bearings, design of unreinforced elastomeric bearings, expansion joints.	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Classify different types of bridges and select appropriate forms with economic span lengths.
2	Identify and evaluate design loads and forces acting on bridges as per IRC specifications.
3	Apply design methods for R.C.C. deck slabs, T-beams, box culverts, and balanced cantilever bridges.

4	Demonstrate knowledge of construction techniques for substructures, abutments, retaining walls, and erection of superstructures.
5	Design abutments, piers, approach slabs, bearings, and expansion joints for various bridge systems.
6	Assess inspection, maintenance, and repair methods to ensure safety and serviceability of bridges.

	Text Books
1	Design of Bridges – N. Krishna Raju, Oxford & IBH Publishing, 4th Ed., 2019.
2	Bridge Engineering – S.P. Bindra, Dhanpat Rai Publications
3	Concrete Bridge Practice by Dr. V.K. Raina Tata McGraw Hill Pub. Co.
4	Design of Bridge Structures – T.R. Jagadeesh & M.A. Jayaram, PHI Learning, 2nd Ed., 2012
5	Design of Highway Bridges – R.M. Barker & J.A. Puckett, Wiley, 3rd Ed., 2013.
6	Highway Bridge Superstructure Engineering – N.K. Vaswani, Wiley, 2nd Ed., 2016.
	Reference Books
1	Bridge Engineering Handbook – Wai-Fah Chen & Lian Duan, CRC Press
2	Bridge Management – M.J. Ryall, G.A.R. Parke & J.E. Harding, CRC Press, 2nd Ed., 2010.
3	Prestressed Concrete Bridges – Nigel R. Hewson, Thomas Telford
4	Structural Design of Bridges – W.F. Chen & L. Duan, CRC Press
5	Bridge Design Manual – Ministry of Road Transport and Highways (MORTH)
6	IRC Codes (IRC:6, IRC:18, IRC:21, IRC:83) – Indian Roads Congress
	Useful Websites
1	https://nptel.ac.in – NPTEL Bridge Engineering courses
2	https://www.irc.nic.in – Indian Roads Congress codes and publication
3	https://theconstructor.org – Bridge design concepts and case studies
4	https://www.fhwa.dot.gov/bridge – U.S. Federal Highway Administration bridge resources
5	https://ascelibrary.org – ASCE research papers on bridge design and construction

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	–	–	–	–	1	2	–
CO2	3	2	3	3	3	–	–	–	–	1	2	–
CO3	3	2	3	3	3	1	–	–	–	1	2	1
CO4	3	2	3	3	3	1	–	–	–	1	2	1
CO5	3	2	3	3	2	2	2	1	–	1	2	1
CO6	3	2	3	3	2	2	1	1	1	1	2	1

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering)
Semester- I

2501PCSTPE1042: Structural Health Monitoring

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	---	**ESE**	60 Marks
Total Credits	03	**TW**	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand factors influencing structural health and causes of structural distress.
2. To study concepts and methods of structural health monitoring and auditing.
3. To learn field testing techniques for evaluating structural performance under static and dynamic conditions.
4. To gain knowledge of repair, rehabilitation, and smart material applications in structural health assessment.

	Course Contents	Hours
Unit 1	Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.	(08)
Unit 2	Structural Health Monitoring: Concepts Various Measures, Structural Safety in Alteration.	(08)
Unit 3	Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation, Management, SHM Procedures.	(06)
Unit 4	Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.	(06)
Unit 5	Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.	(06)
Unit 6	Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo– electric material and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Identify causes of structural distress and importance of regular maintenance.
2	Apply concepts of structural health monitoring for assessing safety of altered structures
3	Conduct structural audit and evaluate procedures for collapse investigations.
4	Perform static and dynamic field tests with appropriate sensors and data acquisition systems.
5	Analyze stress history and dynamic response data for structural performance evaluation.
6	Suggest suitable repair, rehabilitation techniques, and smart material applications in structural health monitoring.

	Text Books
1	Structural Health Monitoring – Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Wiley, 1st Edition, 2006.
2	Structural Health Monitoring: A Machine Learning Perspective – Charles R. Farrar, Keith Worden, Wiley, 1st Edition, 2012.
3	Maintenance and Repair of Civil Structures – B.L. Gupta, Standard Publishers, 3rd Edition, 2015.
4	Health Monitoring of Structural Materials and Components – Douglas E. Adams, Wiley, 1st Edition, 2007.
5	Repair and Rehabilitation of Concrete Structures – Poonam I. Modi, Jaypee Brothers, 2nd Edition, 2018.
	Reference Books
1	Structural Condition Assessment – Robert T. Ratay, Wiley, 2nd Edition, 2009
2	Structural Assessment: The Role of Large and Full-Scale Testing – F.K. Garas, K. M. Holford, S.S. Suraya, CRC Press, 1st Edition, 2008.
3	Handbook on Repair and Rehabilitation of RCC Buildings – CPWD, Government of India, 1st Edition, 2002.
4	Reinforced Concrete: Repair and Rehabilitation – R. Dodge Woodson, Butterworth-Heinemann, 1st Edition, 2009.
5	Durability of Concrete and Cement Composites – C.L. Page, M.M. Page, Woodhead Publishing, 2nd Edition, 2007.
6	Smart Structures: Innovative Systems for Seismic Response Control – Kazuhiko Kasai, Springer, 1st Edition, 2016.
	Useful Websites
1	https://nptel.ac.in – Free online lectures on structural health monitoring and rehabilitation.
2	https://theconstructor.org – Articles and examples on SHM, structural audit, and repairs.
3	https://www.shmii.org – International Society for SHM of Intelligent Infrastructure
4	https://civilengineeringnotes.com – Notes and tutorials on repair, retrofitting, and SHM.
5	https://theconstructor.org – SHM, NDT methods, and practical engineering articles

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	2	1	-	1	-	2
CO2	3	2	3	2	2	-	2	1	-	1	-	2
CO3	3	3	3	2	2	1	3	2	-	2	1	3
CO4	3	3	3	3	3	2	2	1	-	1	-	2
CO5	3	3	3	3	3	2	2	1	-	1	-	2
CO6	3	2	3	2	2	2	3	2	2	2	-	3

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPE1043: Repairs and Rehabilitation of Structure

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	---	**ESE**	60 Marks
Total Credits	03	**TW**	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand the causes of deterioration and distress in concrete and steel structures
2. To develop knowledge of damage assessment, inspection, and evaluation procedures
3. To study repair, rehabilitation, and retrofitting techniques for concrete structures.
4. To familiarize with modern materials, innovative methods, and seismic retrofitting approaches.

	Course Contents	Hours
Unit 1	Introduction to deterioration of structures with aging; Need for rehabilitation. Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.	(08)
Unit 2	Distress in concrete /steel structures Types of damages; Sources or causes for damages; effects of damages; Case studies, Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness.	(08)
Unit 3	Damage assessment and evaluation models Damage testing methods; Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.	(06)
Unit 4	Rehabilitation methods Grouting; Detailing; Imbalance of structural stability; Polymer concrete, Sulphur infiltrated concrete, Fiber reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes. Case studies	(06)
Unit 5	Methods of Repair Shortcreting; Grouting; Epoxy-cement mortar injection; Crack ceiling Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – DEMOLITION TECHNIQUES – Engineered demolition methods Case studies.	(06)
Unit 6	Seismic Retrofitting of reinforced concrete buildings Introduction; Considerations in retrofitting of structures; Source of weakness in RC frame building – Structural damage due to discontinuous load path; Structural damage due to lack of deformation; Quality of workmanship and materials; Classification of retrofitting techniques; Retrofitting strategies for RC buildings – Structural level (global) retrofit methods; Member level (local) retrofit methods; Comparative analysis of methods of retrofitting	(06)

	Course Outcomes (CO): At the end of course, students will able to
1	Identify various causes of deterioration in structures and the importance of maintenance.
2	Analyze types of distress, damages, and their effects in concrete and steel structures.
3	Evaluate structures using non-destructive testing and assessment models.
4	Apply advanced repair and rehabilitation techniques for different structural problems.
5	Select suitable materials and innovative concretes for rehabilitation projects.
6	Propose and design seismic retrofitting strategies for RC buildings.
	Text Books
1	Concrete Structures – Repair, Rehabilitation and Retrofitting – P.C. Varghese, PHI Learning, 2nd Edition, 2
2	Retrofitting of Structures – A.K. Jain, Khanna Publishers
3	Repair and Rehabilitation of Concrete Structures – P. I. Modi & C. N. Patel, PHI Learning
4	Maintenance, Repair and Rehabilitation of Concrete Structures – B.L. Gupta & Amit Gupta, Standard Publishers, 2nd Edition, 2014.
5	Repair, Protection and Waterproofing of Concrete Structures – P. Jagadeesh, New Age International, 1st
6	Repair and Rehabilitation of Concrete Structures – R.D. Patel, CBS Publishers, 1st Edition, 2016
	Reference Books
1	Handbook on Repair and Rehabilitation of RCC Buildings – CPWD, Government of India, 2002.
2	Concrete Repair: A Practical Guide – Michael Raupach & Carola Forster, CRC Press, 1st Edition, 2014
3	Structural Rehabilitation in Seismic Zones – S.K. Duggal, Oxford University Press, 1st Edition, 2013.
4	IS 15988:2013 – Seismic Evaluation and Strengthening of Existing RCC Buildings – Guidelines
5	ACI 562-19 – Code Requirements for Assessment, Repair and Rehabilitation of Concrete Structures
	Useful Websites
1	https://nptel.ac.in – NPTEL lectures on repair, retrofitting, and NDT
2	https://theconstructor.org – Technical articles and case studies
3	https://civilnote.com – Structural rehabilitation and repair materials
4	https://www.cpwd.gov.in – CPWD guidelines on repair and rehabilitation practices.
5	https://www.bis.gov.in – BIS codes (IS 13920, IS 1893, IS 456, repair & retrofitting codes).

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	2	2	-	1	-	1	2
CO2	3	3	2	2	2	2	2	-	1	-	2	2
CO3	3	3	3	2	2	2	2	-	1	2	2	3
CO4	2	2	3	2	2	3	2	-	2	2	2	3
CO5	2	2	3	2	3	3	2	-	2	2	2	3
CO6	2	3	3	3	3	3	2	2	2	2	2	3

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPE1051: Advanced Structural Analysis

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Understand the advanced methods for analyzing indeterminate structures
2. Apply matrix and energy methods to determine internal forces and deformations
3. Analyze structures under various static and dynamic loads
4. Use computational tools and software in structural analysis problems

	Course Contents	Hours
Unit 1	**Review of Classical Methods** Review of force and displacement methods, Application to beams, frames, and trusses, Analysis of statically indeterminate structures, Influence lines for indeterminate structures, Rolling loads and Muller–Breslau principle	(08)
Unit 2	**Flexibility and Stiffness Methods** Concept of flexibility and stiffness matrices, Development of flexibility method, Development of stiffness method, Comparison of flexibility and stiffness approaches, Application to simple structures	(08)
Unit 3	**Matrix Method of Structural Analysis** Introduction to matrix formulation, Element stiffness matrix and global stiffness matrix, Assembly process, Boundary conditions and solution, Application to continuous beams, trusses, and portal frames	(06)
Unit 4	**Energy Methods and Approximate Analysis** Principle of virtual work, Castigliano's theorems, Unit load method for deflection, Approximate methods for tall buildings and multi-storey frames, Portal and cantilever methods	(06)
Unit 5	**Influence Line Diagrams and Moving Loads** Influence line diagrams (ILDs) for statically indeterminate structures, ILDs using Muller–Breslau principle, moving loads on girders and trusses, Maximum shear and moment envelopes, Application to bridge structures	(06)
Unit 6	**Computer Aided Structural Analysis** Introduction to structural analysis software, Pre-processing and post-processing techniques, Modelling beams, trusses, and frames, Interpretation of software outputs, Limitations and verification with manual calculations	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Apply classical methods to analyze indeterminate structures
2	Formulate and solve structural problems using stiffness and flexibility methods

3	Develop matrix-based models for analyzing different types of structures
4	Utilize energy principles and approximate methods in analyzing complex structures
5	Construct and interpret influence line diagrams for different structural elements
6	Analyze and verify structural systems using commercial software tools

Text Books	
1	Advanced Structural Analysis – Devdas Menon, Narosa Publishing House
2	Matrix Methods of Structural Analysis – Meghre & Deshmukh, Charotar Publishing House
3	Advanced Structural Analysis – C.K. Wang, McGraw Hill Education
4	Matrix Analysis of Structures – Aslam Kassimali, Cengage Learning
5	Theory of Structures – Vol. II – B.C. Punmia et al., Laxmi Publications
6	Structural Analysis: A Matrix Approach – G.S. Pandit & S.P. Gupta, Tata McGraw Hill

Reference Books	
1	Structural Analysis – R.C. Hibbeler, Pearson Education
2	Matrix Structural Analysis – William Weaver Jr. & James Gere, Van Nostrand Reinhold
3	Matrix Analysis of Framed Structures – William McGuire et al., Wiley
4	Matrix Structural Analysis – Kanchi M.B., Wiley Eastern Ltd
5	Finite Element Analysis: Theory and Programming – C.S. Krishnamoorthy, Tata McGraw Hill
6	Computer Methods of Structural Analysis – F.C. Filippou, Springer

Useful Websites	
1	https://nptel.ac.in – NPTEL structural analysis video courses
2	https://www.civilera.com – Tutorials and case studies on advanced structural analysis
3	https://ascelibrary.org – Research articles on structural analysis
4	https://theconstructor.org – Theory, examples, and software tutorials
5	https://www.etabs.com – ETABS official resources and user guides

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	–	–	–	–	1	1	–
CO2	3	3	3	3	3	–	–	–	–	1	2	–
CO3	3	3	3	3	3	1	–	–	–	1	2	–
CO4	3	2	3	3	2	2	–	–	–	1	2	1
CO5	3	2	3	3	2	2	–	–	–	1	2	1
CO6	3	3	3	3	3	2	1	–	1	1	2	1

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPE1052: Stability of Structures

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	---	**ESE**	60 Marks
Total Credits	03	**TW**	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand concepts, criteria, and behavior related to structural stability.
2. To analyze stability of columns, beams, and frames under various loading and boundary conditions.
3. To study inelastic and dynamic stability behavior of structural members.
4. To apply theoretical methods to predict stability and prevent failure in structures.

	Course Contents	Hours
Unit 1	**Introduction to Structural Stability** Introduction- concept of stability, static dynamic and energy criterion of stability. Flexibility and stiffness criteria. Snap through & post buckling behaviour	(08)
Unit 2	**Stability of Column** Stability of columns Critical load for standard boundary conditions, elastically restrained perfect column, effect of transverse shear in buckling, column with geometric imperfections, eccentrically loaded columns, orthogonality of buckling modes, large deformation theory for columns	(08)
Unit 3	**Stability of continuous beams and frames** Moment distribution and stiffness method for stability analysis of continuous beams and frames	(06)
Unit 4	**Lateral Buckling of Beams** Lateral buckling of beam Differential equations for lateral buckling, lateral buckling of beam in pure bending, lateral buckling of beam subjected to concentrated and uniformly distributed force	(06)
Unit 5	**Inelastic stability of columns** Inelastic buckling, double modulus theory, tangent modulus theory, Shanley's theory of inelastic buckling, eccentrically loaded inelastic column	(06)
Unit 6	**Dynamic stability of structure** Discrete system, Lagrange-Hamilton formulation for continuous system, stability of continuous system, general method for conservative and non-conservative system	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Explain stability criteria and post-buckling behavior of structures.
2	Determine critical loads and stability behavior of columns with various end conditions.
3	Analyze continuous beams and frames for stability using moment distribution and stiffness methods.
4	Solve lateral buckling problems for beams under different loading conditions.

5	Apply inelastic buckling theories to predict column behavior beyond elastic limits
6	Evaluate dynamic stability of discrete and continuous systems using Lagrange-Hamilton methods.

	Text Books
1	Theory of Elastic Stability – Stephen Timoshenko & James Gere, McGraw Hill, 2nd Edition, 1961
2	Structural Stability of Steel: Concepts and Applications for Structural Engineers – Theodore V. Galambos, Wiley, 2nd Edition, 1998.
3	Stability of Structures: Principles and Applications – Z. P. Bažant & L. Cedolin, Springer, 2nd Edition, 2010
4	Advanced Structural Analysis – Devdas Menon, Narosa Publishing, 1st Edition, 2010
5	Theory of Elastic Stability of Structures – A.S. Biggs, Oxford University Press, 1st Edition, 1964.
6	Structural Analysis and Stability – R. Narayanan, PHI Learning, 1st Edition, 2012.

	Reference Books
1	Structural Stability of Steel and Composite Structures – R.C. Sharma & S.S. Pande, CRC Press, 1st Edition,
2	Stability Theory of Structures – W. Prager & P.G. Hodge, Dover, 1st Edition, 1972.
3	Elastic and Inelastic Stability of Structures – A.K. Chopra, Pearson, 2nd Edition, 2012.
4	Structural Analysis and Design – C.S. Reddy, McGraw Hill, 3rd Edition, 2011.
5	Advanced Analysis of Structures – C.K. Wang, John Wiley, 1st Edition, 1972.
6	Structural Stability and Nonlinear Analysis – G. P. Timoshenko, D.H. Young, Van Nostrand, 2nd Edition

	Useful Websites
1	https://nptel.ac.in – Free lectures on structural stability and advanced structural analysis.
2	https://theconstructor.org – Articles and examples on buckling, column and beam stability.
3	https://ascelibrary.org – ASCE papers on structural stability and dynamic buckling.
4	https://sciencedirect.com – Research papers on elastic and inelastic stability of structures.
5	https://structurae.net – Database of structures with stability and buckling case studies.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	2	1	1	-	1	1	2
CO2	3	3	3	2	2	2	2	1	1	2	2	2
CO3	3	3	3	3	3	2	2	1	2	2	2	3
CO4	3	3	3	2	3	3	2	1	2	2	2	3
CO5	3	3	3	2	3	3	2	2	2	2	2	3
CO6	3	3	3	3	3	3	2	2	2	2	2	3

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTPE1053: Dynamic of Structures

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Understand the basic concepts and principles of structural dynamics
2. Formulate and solve dynamic equations of motion for various structures
3. Analyze the response of structures subjected to different types of dynamic loads
4. Apply the concepts of damping, resonance, and vibration control in design

	Course Contents	Hours
Unit 1	**Introduction to Structural Dynamics** Importance of dynamic analysis, Types of dynamic loads: wind, earthquake, machine-induced, Free and forced vibrations, Equation of motion: single-degree-of-freedom (SDOF) systems, Damping concepts and types	(08)
Unit 2	**Response of SDOF Systems** Free vibration with and without damping, Forced vibration under harmonic loading, Response to periodic and non-periodic loads, Duhamel's integral, Response spectrum	(08)
Unit 3	**Multi-Degree-of-Freedom (MDOF) Systems** Formulation of equations of motion, Evaluation of natural frequencies and mode shapes, Orthogonality of modes, Modal superposition method, Lumped and consistent mass matrices	(06)
Unit 4	**Continuous Systems** Dynamic behaviour of beams and frames, Derivation of wave equation, Mode shapes and natural frequencies, Application of Rayleigh and Dunkerley methods, Introduction to finite element approach for dynamic problems	(06)
Unit 5	**Earthquake Ground Motion and Structural Response** Characteristics of ground motion, Seismic parameters and design spectra, Seismic analysis of structures, Base shear calculation, Time history and response spectrum methods	(06)
Unit 6	**Applications and Advanced Topics** Vibration control and isolation, tuned mass dampers (TMDs), Active and passive damping devices, Structural dynamics using software (e.g., ETABS, SAP2000), Case studies on earthquake response of buildings	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Understand the fundamentals of structural dynamics and vibration principles
2	Formulate and solve equations of motion for SDOF and MDOF systems

3	Analyze the dynamic response of structures to various types of loading
4	Evaluate modal parameters and apply modal analysis techniques
5	Interpret earthquake ground motion and assess structural behavior under seismic loading
6	Apply structural dynamics principles using software tools for real-life analysis

Text Books	
1	Dynamics of Structures: Theory and Applications to Earthquake Engineering – Anil K. Chopra, *Pearson Education*
2	Structural Dynamics: Theory and Computation – Mario Paz & William Leigh, *Springer*
3	Dynamics of Structures – R.W. Clough & J. Penzien, *McGraw Hill Education*
4	Fundamentals of Structural Dynamics – Roy R. Craig & Andrew J. Kurdila, *Wiley*
5	Structural Dynamics – M. Mukhopadhyay, *ANE Books*
6	Vibration Problems in Engineering – S. Timoshenko, D.H. Young & W. Weaver, *Wiley*
Reference Books	
1	Structural Dynamics – P. Dayaratnam, *Wiley Eastern Limited*
2	Seismic Analysis of Structures – T.K. Datta, *John Wiley & Sons*
3	Elements of Structural Dynamics – Clough and Penzien, *McGraw Hill*
4	Earthquake Resistant Design of Structures – Pankaj Agarwal & Manish Shrikhande, *PHI Learning*
5	Vibration of Continuous Systems – Singiresu S. Rao, *Wiley*
6	Earthquake Engineering for Structural Design – W.H. Robinson & D.J. Thambiratnam, *Spon Press*
Useful Websites	
1	https://nptel.ac.in – NPTEL video lectures on structural dynamics and earthquake engineering
2	https://theconstructor.org – Articles and tutorials on vibration and dynamic analysis
3	https://ascelibrary.org – Research and case studies related to structural dynamics
4	https://etabs.com – Structural software for vibration and dynamic response analysis
5	https://www.fema.gov – Resources on seismic and disaster-resilient structural design

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	–	–	–	–	–	1	–
CO2	3	3	3	3	2	–	–	–	–	–	1	–
CO3	3	3	3	3	3	–	–	–	–	–	2	1
CO4	3	3	3	3	3	1	–	–	–	–	2	1
CO5	3	2	3	3	3	2	–	–	–	–	2	1
CO6	3	3	3	3	3	2	1	–	–	1	2	1

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTLC106: Laboratory Practices

Teaching Scheme		Examination Scheme	
Lectures	----	ISE	----
Practical	04 Hrs./week	ESE	----
Total Credits	02	TW	25
		POE	25

Course Objectives (CO)

1. To develop a practical understanding of material behavior and structural responses.
2. To expose students to advanced testing equipment and analytical procedures.
3. To correlate theoretical knowledge with experimental observations.
4. To encourage analytical thinking and interpretation of structural behavior using modern tools.

	Course Contents	Hours
Group A	**Material Characterization (Any 2)** 1. Concrete mix design (M30/M40) and testing of workability & strength 2. Flexural and split tensile strength test of hardened concrete 3. Testing of high-strength concrete using compressive testing machine (CTM) 4. Microstructural analysis using SEM or petrographic analysis (demo-based)	08
Group B	**Structural Element Testing (Any 2)** 1. Testing of RC beam for flexure and shear – load vs deflection behaviour 2. Load testing of column model to study failure pattern and crushing load 3. Model testing of slab panel (two-way) – deflection and cracking pattern 4. Testing of beam retrofitted with FRP or jacketing	08
Group C	**Advanced Instrumentation (Any 1)** 1. Strain measurement using strain gauges and data acquisition 2. Dynamic testing of structure models using accelerometers or vibration meter 3. Health monitoring demo using smart sensors or NDT tools0	08
Group D	**Software-based Laboratory (Any 1)** 1. Finite Element Analysis of beam/column using ANSYS, MIDAS, SAP2000, or STAAD Pro 2. Modal analysis or dynamic response using software tools 3. Use of MATLAB or Python for solving numerical structural problems	08

Course Outcomes (CO): At the end of course, students will able to

1	Understand experimental procedures for testing structural materials and elements.
2	Evaluate the mechanical properties of construction materials under different loading
3	Analyze structural behavior through lab-scale element testing

4	Apply advanced instrumentation and monitoring techniques in structural experiments
5	Use computer software for structural modeling and analysis
6	Interpret and document test results with logical conclusions and reports

	Text Books
1	Concrete Technology – M.S. Shetty, *S. Chand Publishers*
2	Advanced Reinforced Concrete Design – P.C. Varghese, *PHI Learning*
3	Experimental Stress Analysis – Sadhu Singh, *Khanna Publishers*
4	Laboratory Manual in Structural Engineering – S.K. Bhattacharya, *New Age International*
5	Non-Destructive Testing of Materials – B. Raj et al., *Narosa Publishing*
	Reference Books
1	Handbook on Experimental Mechanics – Prasad & Kumar, *CRC Press*
2	Design and Control of Concrete Mixtures – PCA, *Portland Cement Association*
3	Structural Analysis with Finite Elements – J.F. Doyle, *Wiley*
4	Experimental Methods for Engineers – J.P. Holman, *McGraw-Hill*
5	Finite Element Analysis – C.S. Krishnamoorthy, *Tata McGraw-Hill*
	Useful Websites
1	https://nptel.ac.in – Structural engineering and lab demo lectures
2	https://theconstructor.org – Practical guides and test methods
3	https://icivilengineer.com – Lab manuals and tutorials
4	https://engineeringcivil.com – Test setups and case studies
5	https://asce.org – Research papers, codes, and experiments

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	–	–	–	–	–	–	–	2	–
CO2	3	3	3	2	–	–	–	–	–	–	2	–
CO3	3	3	3	2	–	–	–	–	–	–	2	1
CO4	3	3	3	2	3	2	–	–	–	–	2	2
CO5	3	2	3	3	3	2	–	–	–	–	2	2
CO6	3	2	3	2	2	2	–	–	–	2	2	2

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY ★ Autonomous ★ Warananagar

Note:
The Oral Examination (OE) will be based on the performance of laboratory work conducted under the various groups mentioned in the syllabus.
The submission consists of the completed laboratory journal, which must include the write-ups of all practical's performed in the laboratory under the respective groups.

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- I

2501PCSTSW107: Seminar-I

Teaching Scheme		Examination Scheme	
Lectures	----	ISE	----
Practical	02 Hrs./week	ESE	----
Total Credits	01	TW	50
		POE	---

Course Objectives (CO)

1. To enhance the student's ability to research, understand, and present technical content
2. To develop confidence in public speaking and technical communication
3. To promote critical thinking and literature analysis on recent advancements in structural engineering
4. To prepare students for effective technical writing and report documentation.

	Course Contents	Hours
Stage A	**Topic Selection & Approval** • Emerging trends in structural materials • Recent codes & standards in earthquake/bridge/high-rise design • Sustainable construction techniques • Applications of AI/ML or software tools in structural engineering • Structural failures, retrofitting case studies • Smart materials, sensors, or structural health monitoring	06
Stage B	**Literature Survey** • Minimum of 8–10 technical papers (journal/conference) • Review of standards, textbooks, and web resources	06
Stage C	**Seminar Report Preparation** • Introduction, literature review, methodology, results/discussion, conclusion • Report must be prepared as per standard format (typed, spiral-bound, 20–25 pages)	06
Stage D	**Presentation & Viva** • 10–15-minute PowerPoint presentation • Q&A session by faculty panel • Peer review & feedback	06

Course Outcomes (CO): At the end of course, students will able to

1	Identify and explore emerging research areas in structural engineering
2	Perform comprehensive literature reviews from journals and technical sources
3	Analyze and interpret existing work to identify research gaps
4	Prepare a structured seminar report using academic writing conventions
5	Deliver an effective oral presentation with confidence and clarity

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY
Autonomous
Warananagar

6	Participate in discussions, respond to questions, and defend presented work.
	Text Books
1	Technical Communication: Principles and Practice – Meenakshi Raman & Sangeeta Sharma, *Oxford University Press*
2	Scientific Writing: A Reader and Writer's Guide – Jean-Luc Lebrun, *Springer*
3	Presentation Skills for Engineers – Mark Wiskup, *Career Press*
4	Engineering Communication – Charles W. Knisely & Karin I. Knisely, *Cengage Learning*
5	Research Methodology – Ranjit Kumar, *SAGE Publications*
	Reference Books
1	The Craft of Scientific Presentations – Michael Alley, *Springer*
2	Research Methodology: Methods and Techniques – C.R. Kothari, *New Age International*
3	Technical Writing for Engineers & Scientists – Leo Finkelstein, *McGraw-Hill*
4	Engineering Research Methodology – R. Venkatraman, *PHI Learning*
5	Communication Skills for Engineers – Sunita Mishra & C. Muralikrishna, *Pearson Education*
	Useful Websites
1	https://nptel.ac.in – Research methodology and technical presentation courses
2	https://ascelibrary.org – Research articles from ASCE journals
3	https://sciencedirect.com – Access to technical literature
4	https://slideshare.net – Sample seminar presentations
5	https://researchgate.net – Free access to technical papers and discussion

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	–	–	–	–	–	–	1	–
CO2	3	2	–	–	1	–	–	–	–	–	2	1
CO3	3	3	2	1	–	–	–	–	–	–	2	2
CO4	3	–	2	–	–	–	–	–	–	2	2	2
CO5	2	–	–	–	–	–	–	–	–	3	2	–
CO6	2	2	–	–	–	–	–	–	2	3	2	–

NOTE:
The submission shall include a well-bonded seminar report prepared in the proper IEEE format provided by department, along with the following:

- A file containing printouts of a minimum of 10 research papers,
- Detailed literature reviews, and
- Printouts of PowerPoint presentation slides

M Tech (Structure)

First Year

Semester-II

Syllabus of Course offered

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPCC201: Theory of Elasticity and Plasticity

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	01 Hrs./Week	ESE	60 Marks
Total Credits	04	TW	25 Marks
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Understand the fundamental concepts of stress, strain, and constitutive relations in elasticity and plasticity
2. Formulate and solve two- and three-dimensional elasticity problems using analytical methods
3. Explore yield criteria and plastic deformation behavior of structural materials
4. Apply elasticity and plasticity theory to analyze complex structural components under various loading conditions

	Course Contents	Hours
Unit 1	Stress & Strain at a point, static indeterminacy of problem of 3-D elasticity, Stress equilibrium equations in rectangular, cylindrical & spherical co-ordinates, Generalized Hooke's Law, rectangular, cylindrical and spherical co-ordinates, Generalized Hooke's Law, Strain compatibility equations, Stress compatibility equations	(08)
Unit 2	Applications of theory of elasticity: Plane stress and plane strain problem in 2 D elasticity, Airy's stress function & its applications to beam bending problems	(08)
Unit 3	Principal Stresses and strains in 3-D, stress & strain invariants, numerical problems.	(06)
Unit 4	Torsion: Shafts of circular and non-circular prismatic sections, Venant's theory, warping function approach, stress function approach.	(06)
Unit 5	Plasticity: hydrostatic stresses, deviatoric stresses, invariants of deviatoric stresses, various failure theories, various empirical stress –strain relationships, theories of plastic flow, yield, criteria, von Misses, Tresca yield criteria, strain hardening.	(06)
Unit 6	Applications of plasticity. Elastic perfectly plastic materials, plane stress- plane strain problems in plasticity, an application to thick cylinders, thick spheres.	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Understand the stress-strain behavior of elastic and plastic materials
2	Apply elasticity theory to solve 2D and axisymmetric problems

3	Analyze torsional problems involving non-circular sections
4	Interpret yield criteria and predict plastic behavior of materials
5	Solve structural problems involving combined elastic and plastic deformations
6	Use analytical and numerical methods for practical elasticity and plasticity problems

	Text Books
1	Theory of Elasticity – Timoshenko & Goodier, *McGraw-Hill*
2	Applied Elasticity – S. Timoshenko & J.N. Goodier, *CBS Publishers*
3	Theory of Elasticity and Plasticity – Sadhu Singh, *Khanna Publishers*
4	Elasticity – J.R. Barber, *Springer*
5	Introduction to Plasticity – J. Chakrabarty, *Springer*
6	Elastic and Plastic Analysis of Structures – M. Hill, *Cambridge University Press*
	Reference Books
1	Advanced Mechanics of Materials – A.P. Boresi & R.J. Schmidt, *Wiley*
2	Plasticity for Structural Engineers – C. R. Calladine, *Elsevier*
3	Continuum Mechanics and Plasticity – Han-Chin Wu, *CRC Press*
4	Fundamentals of Solid Mechanics – M.L. Gambhir, *PHI Learning*
5	Engineering Plasticity – W. Johnson & P.B. Mellor, *Van Nostrand Reinhold*
6	Finite Elements and Plasticity – D.R.J. Owen & E. Hinton, *Pineridge Press*
	Useful Websites
1	https://nptel.ac.in – Courses on elasticity, plasticity, and solid mechanics
2	https://efunda.com – Engineering fundamentals including elasticity and materials
3	https://theconstructor.org – Articles on stress-strain and structural analysis
4	https://sciencedirect.com – Research papers and journals on elasticity/plasticity
5	https://mechanicalc.com – Online calculators and theory summaries for mechanics

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	–	–	–	–	–	–	–	–
CO2	3	3	3	3	–	–	–	–	–	–	1	1
CO3	3	3	3	2	2	–	–	–	–	–	1	1
CO4	3	3	3	3	2	1	–	–	–	–	2	1
CO5	3	2	3	3	3	2	–	–	–	–	2	1
CO6	3	3	3	3	3	2	–	–	–	1	2	2

Term Work: The term work part should include one assignment on each unit including problems (If any)

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPCC202: Finite Element Methods

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	01 Hrs./Week	**ESE**	60 Marks
Total Credits	04	**TW**	25 Marks
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To Understand the fundamentals and mathematical formulation of the Finite Element Method (FEM)
2. To Analyze structural problems using 1D, 2D, and 3D finite elements
3. To Develop stiffness matrices for various elements using numerical methods
4. To Apply FEM in solving real-life engineering problems using software tools

	Course Contents	Hours
Unit 1	**Fundamentals of FEM** Introduction to Finite Element Method: Principle of minimum potential energy. Variational principle, Galerkin approach, RayleighRitz method, finite element procedure	(08)
Unit 2	**Finite Element Formulation** Element and global stiffness matrices, Assembly and application of boundary conditions, Analysis of bar and truss elements, Analysis of beams and frames in 1D, Axial and flexural deformations	(08)
Unit 3	**2D Finite Element Formulation** CST and LST elements, Plane stress and plane strain problems, Element matrices using shape functions, Isoperimetric formulation, Numerical integration (Gaussian quadrature)	(06)
Unit 4	**Axisymmetric and 3D Elements** Axisymmetric formulation, Axisymmetric solid elements, Tetrahedral and hexahedral elements, Applications in civil/structural components, Stress evaluation and post-processing	(06)
Unit 5	**Finite Element Analysis of Structural Components** Plate bending elements (Kirchhoff and Mindlin theories), Shell elements – basic concepts, Dynamic analysis using FEM, Eigenvalue problems for free vibration, Time-dependent loading	(06)
Unit 6	**Software Applications and Case Studies** Introduction to commercial FEM software (ANSYS, ABAQUS, SAP2000), Preprocessing, solution, and postprocessing, Modelling trusses, frames, and slabs, Comparative analysis with classical methods, Case studies in structural applications	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Understand and formulate basic finite element equations
2	Analyze structural elements like bars, beams, and trusses using FEM

3	Develop and use shape functions for 2D elements
4	Apply FEM for solving axisymmetric and 3D solid problems
5	Perform finite element analysis on plates, shells, and dynamic systems
6	Use FEM software to model and analyze structural engineering problems

	Text Books
1	Introduction to Finite Element Method – J.N. Reddy, McGraw Hill Education
2	The Finite Element Method in Engineering – S.S. Rao, Pearson Education
3	Textbook of Finite Element Analysis – P. Seshu, PHI Learning
4	Finite Element Analysis – C.S. Krishnamoorthy, Tata McGraw Hill
5	Finite Element Procedures – K.J. Bathe, Prentice Hall
6	Fundamentals of Finite Element Analysis – David Hutton, McGraw Hill

	Reference Books
1	A First Course in the Finite Element Method – Daryl L. Logan, Cengage Learning
2	Finite Element Analysis – Theory and Programming – C.S. Krishnamoorthy, McGraw Hill
3	Concepts and Applications of Finite Element Analysis – R.D. Cook et al., Wiley
4	Applied Finite Element Analysis – Larry Segerlind, Wiley
5	Finite Elements in Engineering – Chandrupatla & Belegundu, Pearson Education
6	Numerical Methods in Finite Element Analysis – K.J. Bathe & E.L. Wilson, Prentice Hall

	Useful Websites
1	https://nptel.ac.in – NPTEL courses on FEM and FEA applications
2	https://www.ansys.com – FEM simulation tutorials and tools
3	https://abaqus-docs.mit.edu – ABAQUS user guide (academic access)
4	https://www.simscale.com – Cloud FEM simulation platform
5	https://theconstructor.org – Articles and examples on FEA for civil structures

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	–	–	–	–	1	1	–
CO2	3	3	3	3	3	–	–	–	–	1	2	–
CO3	3	3	3	3	3	1	–	–	–	1	2	–
CO4	3	2	3	3	2	2	–	–	–	1	2	1
CO5	3	2	3	3	2	2	–	–	–	1	2	1
CO6	3	3	3	3	3	2	1	–	1	1	2	1

Term Work: The term work part should include one assignment on each unit including problems (If any)

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPE2031: Advanced Design of Structural Foundations

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Understand the advanced concepts in the design of shallow & deep foundations for various loadings
2. Apply soil-structure interaction principles to foundation design
3. Analyze and design special foundation systems in complex soil and loading conditions
4. Learn the application of IS codes and modern software tools in foundation design

	Course Contents	Hours
Unit 1	**Introduction to Advanced Foundation Design** Overview of soil mechanics and bearing capacity, Foundation behaviour under axial, lateral, and moment loads, Soil-structure interaction, Relevance of site investigation reports	(08)
Unit 2	**Design of Shallow Foundations** Design of isolated, combined, strip, and raft footings, Proportioning of footings, Settlement analysis and control, Foundation design for eccentric and inclined loads	(08)
Unit 3	**Design of Deep Foundations** Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behaviour of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles. Design of single and group piles in cohesive and cohesionless soils	(06)
Unit 4	**Special Foundation Systems** Under-reamed piles, Well foundations and caissons, Use of geosynthetics in foundations, Foundations on collapsible and expansive soils	(06)
Unit 5	**Machine Foundations** Types of machine foundations, Dynamic loads and vibration analysis, Permissible amplitudes and isolation techniques, Design of foundations for impact and rotary machines	(06)
Unit 6	**Codal Provisions and Software Applications** IS 6403, IS 2911, IS 2950, IS 1080 – overview and design examples, Software tools: SAFE, PLAXIS, GEO5, STAAD Foundation, Design case studies of foundation failures and rehabilitation	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Demonstrate understanding of soil-structure interaction in foundation systems
2	Design shallow foundations considering bearing capacity and settlement criteria

3	Analyze and design deep foundations subjected to vertical and lateral loads
4	Design special foundation systems like under-reamed piles, caissons, and geosynthetic-reinforced footings
5	Perform dynamic analysis and design of machine foundations
6	Apply IS codes and software tools for foundation design in real-life problems

Text Books	
1	Foundation Design: Principles and Practices – Donald P. Coduto, *Pearson Education*
2	Design of Reinforced Concrete Foundations – P.C. Varghese, *PHI Learning*
3	Geotechnical Engineering: Principles and Practices – Braja M. Das, *Cengage Learning*
4	Foundation Engineering Handbook – Hsai-Yang Fang, *Springer*
5	Principles of Foundation Engineering – B.M. Das, *Cengage Learning*
6	Design Aids in Soil Mechanics and Foundation Engineering – Kaniraj, *Tata McGraw Hill*
Reference Books	
1	Soil Mechanics and Foundation Engineering – B.C. Punmia, *Laxmi Publications*
2	Analysis and Design of Substructures – Swami Saran, *Oxford & IBH*
3	Pile Foundation Design – Shamsher Prakash & Hari D. Sharma, *McGraw Hill*
4	Machine Foundation Design and Analysis – S. Srinivasulu & Vaidyanathan, *Tata McGraw Hill*
5	Advanced Foundation Engineering – V.N.S. Murthy, *CBS Publishers*
6	IS Codes – IS 6403, IS 2911, IS 2950, IS 1080 – *BIS Publications*
Useful Websites	
1	https://nptel.ac.in – NPTEL lectures on geotechnical and foundation engineering
2	https://theconstructor.org – Articles on shallow and deep foundation design
3	https://geoengineer.org – International geotechnical case studies and foundation innovations
4	https://civilseek.com – Tutorials and code-related explanations
5	https://plaxis.com – FEM software information for geotechnical applications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	–	–	–	–	1	–
CO2	3	3	3	3	3	–	–	–	–	–	2	–
CO3	3	3	3	3	3	–	–	–	–	–	2	1
CO4	3	3	3	3	3	1	–	–	–	–	2	1
CO5	3	2	3	3	3	2	–	–	–	–	2	1
CO6	3	3	3	3	3	2	–	–	–	1	2	1

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPE2032: Theory of Plates and Shells

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand bending, deflection, and stress behavior of thin and thick plates.
2. To analyze rectangular and circular plates under various loading and boundary conditions.
3. To study shell structures, membrane stresses, and equilibrium equations.
4. To apply bending and energy theories for cylindrical and complex shell structures.

	Course Contents	Hours
Unit 1	**Introduction to Plate Theory**: Thin and Thick Plates, small and large deflection theory of thin plates- assumptions, moment-curvature relations, stress resultants, Governing Differential Equation for bending of plates, various boundary conditions.	(08)
Unit 2	**Rectangular plates** -Navier's solution: Simply supported rectangular plates subjected to uniformly distributed and varying loads on entire area, parabolic loads, sinusoidal loads, partly loaded plates, concentrated loads and couples, distributed couples, symmetric & anti- symmetric loading. Rectangular plates - Levy's solution: Plates subject to uniformly distributed and varying loads and sinusoidal parabolic loads between simply supported edges. Conditions for other two edges simply supported, fixed, free, elastically restrained.	(08)
Unit 3	**Energy methods**: Use of potential energy principle, solution of rectangular plates with various boundary conditions and loadings. Buckling of rectangular plates, circular plates.	(06)
Unit 4	**Circular Plates:** Bending of circular plates with clamped & simply supported edges, Plate with a central hole, uniformly distributed and varying loads, conical loads, distributed couples, ring loads, semicircular plates, axisymmetric loaded plates.	(06)
Unit 5	**Introduction to shells**: Classification of shells on geometry, thin shell theory, equation of 05 shell surfaces, stress resultants, stress displacement relations, compatibility and equilibrium equations. Membrane analysis: a. Equation of equilibrium for synclastic shells, solution for shells subject to self-weight, live load. b. Equation of equilibrium in rectangular coordinate system. Hyper shells, use of Puncher's function, simple problems on hyperbolic paraboloids. Elliptic paraboloidal shells, conoids. c. cylindrical shells: Equations of equilibrium, open shells with parabolic, circular, elliptical directrix, simple problems. d. Shells with closed directrix-circular, elliptical-simple problems. Problems on pipes carrying fluid/liquid under pressure, just filled & partly filled	(06)

Unit 6	**Bending theory of cylindrical shells:** Symmetrically loaded circular cylindrical shell. Derivation of Governing Differential Equation, resembling that for beam on elastic foundation, beam theory. Finster Walder's theory: Derivation of governing differential equation of 8th order. D.K.J. theory, Donnell's equation. Characteristic equation. Schorer's theory: Derivation of differential equation.	(06)

Course Outcomes (CO): At the end of course, students will able to	
1	Explain basic concepts and governing equations of plate theory.
2	Solve rectangular plate problems using Navier's and Levy's methods.
3	Apply energy methods to analyze plates and predict buckling behavior
4	Analyze circular plates under different loading and boundary conditions.
5	Understand shell classification, membrane analysis, and solve simple shell problems.
6	Apply bending theories to cylindrical shells using Finster Walder, D.K.J., Donnell, and Schorer's methods

Text Books	
1	*Theory of Plates and Shells* – Timoshenko S. & Woinowsky-Krieger S., McGraw Hill, 2nd Edition, 1959.
2	*Analysis and Design of Plates* – J.N. Reddy, CRC Press, 3rd Edition, 2006.
3	*Plate and Shell Structures: Selected Analytical and Numerical Methods* – V. K. Mathur, Narosa Publishing, 1st Edition, 2012.
4	*Theory and Analysis of Plates* – S. S. Bhavikatti, I.K. International, 2nd Edition, 2011.

Reference Books	
1	*Thin Plates and Shells: Theory, Analysis and Applications* – W. Szilard, Prentice Hall, 1st Edition, 1974.
2	*Advanced Mechanics of Plates and Shells* – L. Librescu & R. S. J. Yang, CRC Press, 2nd Edition, 2003.
3	*Theory of Elastic Plates* – A. S. Solomons, Springer, 1st Edition, 2002.

Useful Websites	
1	https://nptel.ac.in – Free lectures on plates and shell theory.
2	https://theconstructor.org – Articles and solved examples on plates and shells
3	https://structurae.net – Database of plates, shells, and related structures

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	2	-	-	-	-	-	2
CO2	3	3	3	2	2	2	2	-	-	2	2	2
CO3	3	3	3	3	3	2	2	-	2	2	2	3
CO4	3	3	3	2	3	3	2	-	2	2	2	3
CO5	3	3	3	2	3	3	2	2	2	2	2	3
CO6	3	3	3	3	3	3	2	2	2	2	2	3

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPE2033: Advanced Design of RC Structure

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. Learn advanced concepts of reinforced concrete design using limit state philosophy
2. Design RC elements subjected to combined forces, torsion, and seismic effects.
3. Understand detailing and ductile design principles as per IS codes
4. Apply modern techniques and software tools in complex reinforced concrete structures

	Course Contents	Hours
Unit 1	**Advanced Concepts in Limit State Design** Review of basic design philosophy, Interaction curves and combined axial and bending load, Redistribution of moments, Design of deep beams and corbels	(08)
Unit 2	**Torsion, Shear & Compression Members** Theory of torsion in RC members, Design of RC members for torsion and torsion combined with bending and shear, short and slender columns, Design of biaxially loaded columns	(08)
Unit 3	**Flat Slabs and Grid Floors** Introduction to flat slab design, Direct design method and equivalent frame method, Openings in flat slabs, Design of grid floors using IS 456 and IS 337	(06)
Unit 4	**Retaining Walls and Water Tanks** Design of cantilever and counterfort retaining walls, Design of circular and rectangular water tanks, Overhead and underground tanks, IS Code provisions	(06)
it 5	**Ductile Design and Earthquake Resistance** Ductile detailing as per IS 13920, Seismic design of RC frames, Capacity design concepts, Detailing of joints, beams, and columns	(06)
Unit 6	**Introduction to Software-Based RC Design** Use of STAAD, ETABS, and SAFE in RC design, RC detailing tools (AutoCAD, REVIT), Case studies on complex RC structure design, Recent advances in RC design and materials	(06)

Course Outcomes (CO): At the end of course, students will able to

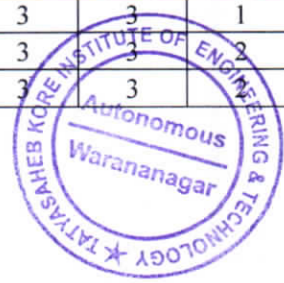
1	Apply limit state method to complex RC members under combined loads
2	Design torsional members and biaxially loaded RC columns using code provisions
3	Design flat slabs and grid floors for multi-Storey buildings
4	Analyze and design retaining walls and water retaining structures
5	Perform earthquake-resistant design and detailing of RC structures

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY Autonomous Warananagar

6	Use software tools for design and detailing of advanced RC structures
	Text Books
1	Advanced Reinforced Concrete Design – P. C. Varghese, *PHI Learning*
2	Limit State Design of Reinforced Concrete – A. K. Jain, *Nem Chand & Bros*
3	Reinforced Concrete Design – S. Unnikrishnan Pillai & Devdas Menon, *Tata McGraw-Hill*
4	Design of Reinforced Concrete Structures – N. Subramanian, *Oxford University Press*
5	Reinforced Concrete Structures – Park & Pauley, *Wiley India*
6	Design of Concrete Structures – Nilson, Darwin & Dolan, *McGraw-Hill*
	Reference Books
1	IS 456: Code of Practice for Plain and Reinforced Concrete – *BIS*
2	IS 13920: Ductile Detailing of RC Structures Subjected to Seismic Forces – *BIS*
3	Reinforced Concrete Structures – Analysis and Design – Chu-Kia Wang, *CBS Publishers*
4	Design of Liquid Retaining Concrete Structures – R.D. Anchor, *Blackie Academic*
5	Seismic Design of Reinforced Concrete Buildings – Jack Moehle, *McGraw-Hill*
6	Reinforced Concrete Structural Elements – Purushothaman, *Tata McGraw-Hill*
	Useful Websites
1	https://nptel.ac.in – Advanced RC design & earthquake detailing courses
2	https://theconstructor.org – Articles and tutorials on RC design
3	https://civilnote.com – Notes and solved examples for RC structures
4	https://engineeringcivil.com – Project work, design spreadsheets
5	https://bentley.com – Structural software tools for RC design

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	–	–	–	–	–	–	–
CO2	3	3	3	2	3	–	–	–	–	–	1	–
CO3	3	3	3	3	3	–	–	–	–	–	2	1
CO4	3	3	3	3	3	1	–	–	–	–	2	1
CO5	3	3	3	3	3	2	–	–	–	–	3	1
CO6	3	3	3	3	3	2	–	–	–	1	2	1



Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPE2041: Advanced Design of Steel Structures

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand advanced concepts in steel and composite structural design.
2. To analyze multi-Storey steel buildings and bridge structures under static, seismic, and wind loads.
3. To study cold-formed steel sections, beam-column buckling, and plastic frame design.
4. To learn design principles of concrete-steel composite sections and encased steel columns.

	Course Contents	Hours
Unit 1	**Design of Trussed girder bridges and bearings**. Deck type and through type bridges, bracing systems, end bearings, mechanical and elastomeric bearings.	(08)
Unit 2	**Multi-storey steel buildings**, load transfer mechanism, lateral load resisting systems, Design of moment resistant frames, concentrically braced frames, interacting moment resisting frames with shear walls for seismic/ wind effects structural systems, framed tube structures, braced tube structures, tube in tube structures	(08)
Unit 3	**Cold-formed light gauge steel sections**, special design considerations for compression elements, design of compression elements, stiffened compression elements, multi stiffened elements, design of light gauge beams, behaviour under repetitive loads and temperature effects.	(06)
Unit 4	**Buckling of beam-column**, buckling of sway and non-sway frame, various end conditions, elastically restrained conditions, stiffness and continuous factor, stability function.	(06)
Unit 5	**Plastic analysis and design of portal frames**, collapse mechanisms, analysis and design of gables, multistorey-multiday frames, rectangular and tapered haunch knee, check for stability of frames, plastic moment distribution method, minimum weight design, variable repetitive loads, Introduction to limit states in steel design.	(06)
Unit 6	**Concrete-Steel composite sections,** elastic behaviour of composite beams, shear connectors, behaviour at ultimate load, design of composite beams, design of encased steel columns.	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Design trussed girder bridges and select appropriate bearing systems.
2	Analyze multi-Storey steel buildings and lateral load resisting systems.
3	Design cold-formed light gauge steel beams and compression elements.

4	Evaluate buckling behavior of beam-columns and steel frames.
5	Apply plastic analysis and design techniques to portal and multi-storey frames.
6	Design concrete-steel composite beams and encased steel columns.

	Text Books
1	Plastic Design of Steel Structures – S.K. Duggal, Tata McGraw Hill, 1st Edition, 2013.
2	Limit State Design of Steel Structures – S.S. Bhavikatti, IK International
3	Design of Steel Structures (IS:800-2007) – N. Subramanian, Oxford University Press
4	Advanced Steel Design – P. Dayaratnam, Wheeler Publishing
5	Design of Steel Structures – N. Krishna Raju, Oxford & IBH Publishing, 4th Edition, 2015.
6	Plastic Design of Steel Frames – L.S. Beedle & M. R. Horne, John Wiley & Sons
	Reference Books
1	Design of Steel Structures – Vol. II – Ramchandra & Virendra Gehlot, Scientific Publishers
2	Handbook of Steel Structures – Akbar R. Tamboli, McGraw Hill Professional
3	Structural Steel Design – Jack C. McCormac, Pearson Education
4	Structural Stability Theory and Practice – S.R. Satish Kumar & A.R. Santhakumar, PHI Learning
5	Steel Structures: Practical Design Studies – S. Kanthimathi & K. Balasubramanian, New Age International
6	IS Codes – IS: 800:2007, IS:875 (Part I to III), IS:801, IS:806, BIS Publications
	Useful Websites
1	https://nptel.ac.in – Advanced Steel Design video lectures
2	https://www.bis.gov.in – Latest IS codes for steel structures
3	https://www.steelconstruction.info – Resources on modern steel construction
4	https://ascelibrary.org – Journals and papers related to steel structures
5	https://theconstructor.org – Design tips, theory, and examples

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	2	2	2
CO2	3	3	3	3	-	1	2	-	2	2	2	3
CO3	3	3	3	2	1	-	2	-	2	2	2	3
CO4	3	3	3	3	3	3	2	-	2	2	2	3
CO5	3	3	3	3	3	3	2	2	2	2	2	3
CO6	3	3	3	3	3	3	2	2	2	2	2	3

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPE2042: Soil Structure Interaction

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	**ISE**	40 Marks
Tutorials	---	**ESE**	60 Marks
Total Credits	03	**TW**	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand conventional and advanced foundation design methods.
2. To apply advanced numerical techniques for soil-structure interaction analysis.
3. To develop and use computational tools for foundation design problems.
4. To analyze various types of foundations including piles and rafts under realistic soil conditions.

	Course Contents	Hours
Unit 1	**Conventional Foundation Design and Soil-Structure Interaction** Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction.	(08)
Unit 2	**Advanced Analysis Techniques** Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.	(08)
Unit 3	**Soil-Structure Interaction Evaluation** Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.	(06)
Unit 4	**Computer-Aided Design Programs for Interaction Problems** Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.	(06)
Unit 5	**Analysis of Frame Structures on Stratified Deposits** Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.	(06)
Unit 6	**Pile Foundations and Negative Skin Friction** Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pullout Resistance.	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Critically evaluate conventional foundation design methods and SSI behavior.
2	Apply FEM and FDM to analyze complex foundation problems.
3	Model soil-structure interaction problems using computer programs
4	Analyze frame structures on stratified deposits under linear and non-linear soil behavior.

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY ★ Autonomous Warananagar

5	Determine pile capacities, negative skin friction, and group pile behavior.
6	Design anchor piles and evaluate pullout resistance for practical conditions

	Text Books
1	Advanced Foundation Engineering – V. N. S. Murthy, CBS Publishers, 2nd Edition, 2010.
2	Foundation Analysis and Design – J.E. Bowles, McGraw Hill, 5th Edition, 2012.
3	Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing
4	Finite Element Method in Geotechnical Engineering – M.H. Chaudhuri, Springer, 1st Edition, 2007.
5	Computer Applications in Geotechnical Engineering – T. K. Datta, PHI Learning, 1st Edition, 2015.
6	Soil-Structure Interaction – C. F. Leung & T. H. Y. Li, CRC Press, 1st Edition, 2010.
	Reference Books
1	Analytical and Computer Methods in Foundation, Bowels J.E.,McGraw Hill Book Co., New York, 1974.
2	Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.
3	Design of Foundations – A. C. Tomlinson, Pearson, 9th Edition, 2014.
4	Advanced Soil Mechanics – Braja M. Das, Taylor & Francis, 4th Edition, 2010.
5	Geotechnical Engineering: Principles and Practices – D. C. Coduto, Pearson, 2nd Edition, 2001
6	Subsoil and Foundation Engineering – P. Purushothama Raj, PHI Learning, 1st Edition, 2012.
	Useful Websites
1	https://nptel.ac.in – Lectures on foundation engineering and SSI.
2	https://theconstructor.org – Articles and solved examples on foundation design.
3	https://ascelibrary.org – Research papers on advanced geotechnical and foundation engineering.
4	https://sciencedirect.com – Journals on pile foundation, soil-structure interaction, and FEM in geotechnics.
5	https://geotechdata.info – Databases and case studies on soil-structure interaction

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	2	1	1	1	2	2	2
CO2	3	3	3	2	2	2	2	1	1	2	2	2
CO3	3	3	3	3	3	2	2	1	2	2	2	3
CO4	3	3	3	2	3	3	2	1	2	2	2	3
CO5	3	3	3	2	3	3	2	2	2	2	2	3
CO6	3	3	3	3	3	3	2	2	2	2	2	3

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTPE2043: Design of High-Rise Buildings

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand the structural concepts and configurations of tall buildings, towers, and chimneys.
2. To analyze and design tall structures and towers under vertical, lateral, wind, and seismic loads.
3. To apply IS code provisions and design standards for safety, durability, and fire protection.
4. To utilize software tools for analysis and design of tall structures and tower systems.

	Course Contents	Hours
Unit 1	**Transmission and TV Towers – Configuration and Bracing** Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system,	(08)
Unit 2	**Transmission and TV Towers – Load Analysis** Design of transmission/ TV tower: analysis and design for vertical transverse and longitudinal loads.	(08)
Unit 3	**Chimneys – RC and Steel** Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.	(06)
Unit 4	**Tall Buildings – Structural Concepts** Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach,	(06)
Unit 5	**Tall Buildings – Design Considerations** Tall Buildings: structural design considerations and IS code provisions. Firefighting design provisions.	(06)
Unit 6	**Software Applications** Application of software in analysis and design.	(06)

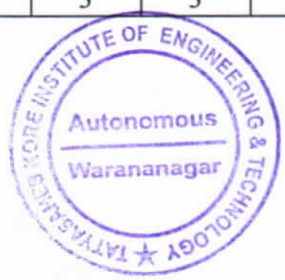
Course Outcomes (CO): At the end of course, students will able to

1	Design and analyze transmission/TV towers, masts, and trestles.
2	Evaluate vertical, transverse, and longitudinal loads on towers.
3	Design RC and steel chimneys including foundations on varied soil conditions.
4	Apply structural concepts and load considerations in tall building design
5	Incorporate IS code provisions, fire safety, and design standards in tall buildings
6	Use software tools effectively for analysis and design of tall structures.

	Text Books
1	Structural Design of Multi-storied Buildings, Varyani U. H., 2nd Ed., South Asian Publishers New Delhi,
2	Design of Multi Storied Buildings, Vol. 1 & 2, CPWD Publications, 1976.
3	Design of Tall Buildings – Bungale S. Taranath, McGraw Hill, 3rd Edition, 2012
4	Structural Design of Tall Buildings – Bryan Stafford Smith & Alex Coull, Wiley, 2nd Edition, 1991.
5	Structural Design of Transmission Towers – S. K. Chaturvedi, Standard Publishers, 1st Edition, 2010.
6	Software Applications in Structural Engineering – T. K. Datta, PHI Learning, 1st Edition, 2015.
	Reference Books
1	Design of Steel Transmission Towers – N. Subramanian, Oxford & IBH, 1st Edition, 2010.
2	illustrated Design of Reinforced Concrete Buildings (GF+3storeyed), Shah V. L. & Karve S. R., Structures Publications, Pune, 2013.
3	Design of Multi Storied Buildings, Vol. 1 & 2, CPWD Publications, 1976.
4	RC and Steel Chimney Design – R. Narayanan, PHI Learning, 1st Edition, 2012.
5	IS 875 (Part 2): Wind Loads – Bureau of Indian Standards, 2nd Edition, 2015.
6	IS 1893: Criteria for Earthquake Resistant Design of Structures – BIS, 5th Edition, 2016
	Useful Websites
1	https://nptel.ac.in – Lectures on tall building and tower design.
2	https://theconstructor.org – Articles and solved examples on chimneys and transmission towers.
3	https://ascelibrary.org – Research papers on tall structures and wind/seismic design
4	https://sciencedirect.com – Journals on tall building structural systems and analysis
5	https://structurae.net – Database of tall buildings, towers, and chimneys worldwide.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	1	1	1	2	2	2
CO2	3	3	3	3	3	2	2	1	2	2	2	3
CO3	3	3	3	3	3	3	2	1	2	2	2	3
CO4	3	3	3	3	3	3	2	1	2	2	2	3
CO5	3	3	3	3	3	3	2	2	2	2	2	3
CO6	3	3	3	3	3	3	2	2	2	2	2	3



Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTOE2051: Cost Management of Engineering Projects

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand the principles and techniques of cost management in engineering projects.
2. To apply project planning, scheduling, and budgeting methods for effective cost control.
3. To analyze project performance using cost estimation, cost control, and earned value techniques
4. To develop skills for decision-making, risk analysis, and resource optimization in project management.

	Course Contents	Hours
Unit 1	**Introduction to Cost Management** Concepts of cost management, objectives, functions, role in engineering projects, cost planning, cost components, project life cycle, cost control fundamentals	(06)
Unit 2	**Cost Estimation and Budgeting** Techniques of cost estimation, types of estimates, preliminary, detailed, and definitive estimates, budgeting process, resource allocation, cash flow planning	(06)
Unit 3	**Project Scheduling and Resource Management** Work Breakdown Structure (WBS), Gantt charts, CPM/PERT, resource leveling, resource smoothing, labor and material scheduling	(06)
Unit 4	**Cost Control and Monitoring** Cost control techniques, cost variance analysis, earned value management (EVM), performance measurement, corrective actions, reporting and documentation	(06)
Unit 5	**Risk and Decision Analysis** Project risk identification, risk analysis, quantitative and qualitative methods, decision-making under uncertainty, sensitivity analysis, project contingency planning	(06)
Unit 6	**Advanced Cost Management Techniques** Life cycle costing, cost-benefit analysis, value engineering, optimization of project costs, use of software tools for cost management (MS Project, Primavera, etc.)	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Explain the principles of cost management and its importance in engineering projects
2	Prepare project budgets, cost estimates, and cash flow plans
3	Apply scheduling and resource allocation techniques to manage project costs effectively.

4	Analyze project performance using earned value management and variance analysis.
5	Implement cost control strategies, risk management, and decision-making techniques.
6	Evaluate project alternatives using cost-benefit analysis, life cycle costing, and optimization methods.

	Text Books
1	Project Management: A Systems Approach to Planning, Scheduling, and Controlling" by Harold Kerzner, 12th Edition, 2017
2	Cost Management of Engineering Projects" by George J. Ritz, 3rd Edition, 2015
3	Project Cost Control in Engineering and Construction" by Y. M. Ganesan, 2nd Edition, 2018
4	Engineering Project Management" by S. K. Sharma, 2nd Edition, 2016
5	Construction Project Management" by K. K. Chitkara, 4th Edition, 2019
6	Project Management and Cost Control" by P. K. Gupta, 2nd Edition, 2018

	Reference Books
1	Project Management for Engineering, Business and Technology" by John M. Nicholas & Herman Steyn, 5th Edition, 2017
2	Cost Estimating and Project Controls" by James J. O'Brien, 3rd Edition, 2016
3	Engineering Economy" by Leland Blank & Anthony Tarquin, 8th Edition, 2019
4	Project Planning and Cost Control" by B. M. Das, 2nd Edition, 2017
5	Value Engineering: Practical Applications" by Larry W. Zimmerman, 2nd Edition, 2015
6	Project Management: Cost, Time, and Quality Management" by John R. Adams, 3rd Edition, 2017

	Useful Websites
1	http://www.pmi.org – Project Management Institute resources, standards, and guides
2	http://www.apm.org.uk – Association for Project Management: tools, case studies, and best practices
3	http://www.constructionexec.com – Articles and examples on construction cost management and budgeting
4	http://www.costengineering.org – Cost engineering techniques, cost control and professional resources
5	http://www.tutorialspoint.com/project_management – Concept notes, solved examples, and exercises

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	1	1	1	1	1	1
CO2	3	3	3	2	2	2	1	1	1	1	1	1
CO3	3	3	3	3	2	2	1	1	1	1	1	1
CO4	3	3	3	3	3	2	1	1	1	1	1	1
CO5	3	3	3	3	3	2	1	1	1	1	1	1
CO6	3	3	3	3	3	3	1	1	1	1	1	1

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTOE2052: Optimization Techniques in Civil Engineering

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs./Week	ISE	40 Marks
Tutorials	---	ESE	60 Marks
Total Credits	03	TW	---
		Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand fundamentals of Operations Research and its role in decision-making.
2. To apply linear and nonlinear programming techniques for optimizing industrial and engineering systems.
3. To analyze scheduling, sequencing, inventory, and network problems using OR tools.
4. To utilize advanced techniques, simulation, and decision-making methods for complex industrial problems.

	Course Contents	Hours
Unit 1	**Linear Programming and Model Formulation** Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	(06)
Unit 2	**Linear Programming Applications** Applications of linear programming in resource allocation, production scheduling, transportation, and assignment problems; use in construction planning, material and cost optimization, mix design, structural and water resource management; sensitivity analysis and application of software tools like Excel Solver, MATLAB, and LINGO for practical problem-solving.	(06)
Unit 3	**Nonlinear Programming and Network Models** Nonlinear programming problem - Kuhn-Tucker conditions, min cost flow problem - max flow problem - CPM/PERT	(06)
Unit 4	**Scheduling, Sequencing, and Inventory Models** Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming	(06)
Unit 5	**Advanced Techniques** Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory, Simulation	(06)
Unit 6	**Decision-Making and Optimization Methods** Advanced Decision-Making Techniques – Markov chains, Replacement Models, Multi-objective Optimization, Transportation and Assignment Problems, Heuristic and Metaheuristic Methods	(06)

Course Outcomes (CO): At the end of course, students will able to

1	Formulate real-world problems as linear and nonlinear programming models.

2	Solve optimization problems using Simplex, sensitivity analysis, and other OR techniques.
3	Analyze and optimize inventory, scheduling, and sequencing problems in industrial systems.
4	Apply network models, CPM/PERT, and flow problems for project and process management.
5	Evaluate and implement advanced OR techniques including dynamic programming, game theory, and simulation.
6	Develop decision-making solutions using Markov chains, multi-objective optimization, and heuristic/metaheuristic methods.

Text Books	
1	Operations Research: An Introduction" by Taha H.A., 10th Edition, 2017
2	Introduction to Operations Research" by Hillier & Lieberman, 10th Edition, 2021
3	Operations Research" by P.K. Gupta & D.S. Hira, 4th Edition, 2018
4	Operations Research: Principles and Applications" by J.K. Sharma, 5th Edition, 2019
5	Linear Programming and Network Flows" by Bazaraa, Jarvis & Sherali, 4th Edition, 2018
6	Operations Research" by S.D. Sharma, 3rd Edition, 2017
Reference Books	
1	Operations Research: Methods and Problems" by Panneerselvam, 2nd Edition, 2018
2	Decision Making in Operations Research" by Wagner, 5th Edition, 2016
3	Optimization in Operations Research" by Ronald A. Howard, 3rd Edition, 2015
4	Simulation Modeling and Analysis" by Averill Law, 5th Edition, 2019
5	Operations Research and Quantitative Analysis" by Frederick S. Hillier, 8th Edition, 2016
6	Quantitative Techniques for Management" by N. D. Vohra, 6th Edition, 2020
Useful Websites	
1	http://www.orjournal.org – Articles, tutorials, and case studies on operations research techniques
2	http://www.sciencedirect.com – Research papers and applications of OR in engineering and management
3	http://www.informs.org – Resources, journals, and software for operations research professionals
4	http://www.mathworks.com – Tutorials and applications for OR modeling using MATLAB
5	http://www.tutorialspoint.com/operations_research – Concept notes, solved examples, and problems

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	1	1	-	1	1	-	1	1
CO2	3	3	2	2	2	2	1	-	1	-	1	-
CO3	3	3	3	3	2	2	1	-	1	-	1	-
CO4	3	3	3	3	3	2	1	1	1	1	1	1
CO5	3	3	3	3	3	2	-	1	-	1	1	1
CO6	3	3	3	3	3	3	1	1	-	1	1	1

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTOE2053: Industrial Safety

Teaching Scheme	
Lectures	03 Hrs./Week
Tutorials	---
Total Credits	03

Examination Scheme	
ISE	40 Marks
ESE	60 Marks
TW	---
Duration of ESE	02 Hrs.30 Min.

Course Objectives (CO)

1. To understand fundamentals of industrial safety and hazard prevention.
2. To apply maintenance engineering principles for effective equipment management.
3. To identify wear, corrosion, and preventive maintenance strategies.
4. To plan and implement periodic and preventive maintenance programs in industries.

	Course Contents	Hours
Unit 1	**Introduction to Industrial Safety** Accident: causes, types, results, control measures, mechanical and electrical hazards: causes and preventive steps, safety color codes, salient points of Factories Act 1948: health, safety, washrooms, drinking water, lighting, cleanliness, guarding, pressure vessels, fire prevention and firefighting: equipment and methods	(06)
Unit 2	**Fundamentals of Maintenance Engineering** Definition, aim, and scope of maintenance engineering, functions and responsibilities of maintenance department, types of maintenance: corrective, preventive, predictive, maintenance tools: types, applications, cost considerations, replacement economy, and service life of equipment	(06)
Unit 3	**Wear: Causes, Effects, and Prevention** Wear: types, causes, effects, and reduction methods, lubricants: types and applications, lubrication methods: screw down grease cup, pressure grease gun, splash, gravity, wick feed, side feed, and ring lubrication with sketches, working, and applications	(06)
Unit 4	**Corrosion: Causes, Types, and Prevention** Corrosion: definition, principles, and factors affecting corrosion, types of corrosion, corrosion prevention methods	(06)
Unit 5	**Periodic Maintenance** Concept, need, and advantages of periodic inspection, degreasing, cleaning, repairing schemes, overhauling of mechanical components and electrical motors, common troubles and remedies of electric motors, repair complexities and their management	(06)
Unit 6	**Preventive Maintenance** Definition, need, steps, and advantages of preventive maintenance, periodic and preventive maintenance procedures for machine tools, pumps, air compressors, DG sets, maintenance program and schedule, repair cycle concept and importance	(06)

	Course Outcomes (CO): At the end of course, students will able to
1	Identify causes and types of industrial accidents and implement safety measures effectively.
2	Analyze mechanical and electrical hazards and apply preventive techniques in industrial operations.
3	Explain principles of maintenance engineering and select appropriate maintenance strategies.
4	Evaluate wear, lubrication, and corrosion issues and recommend suitable prevention methods.
5	Plan and execute periodic maintenance of machines and electrical equipment
6	Design preventive maintenance schedules and implement repair cycle strategies for industrial equipment.
	Text Books
1	Industrial Safety and Accident Prevention" by H. W. McCormick, 4th Edition, 2019
2	Maintenance Engineering Handbook" by Lindley R. Higgins, 9th Edition, 2016
3	Industrial Safety Management" by K. K. Khanna, 3rd Edition, 2020
4	Principles of Maintenance Engineering" by R. C. Mishra, 2nd Edition, 2018
5	Handbook of Industrial Safety" by Robert L. Denning, 2nd Edition, 2015
6	Wear and Corrosion Control in Industry" by R. R. Wilde, 3rd Edition, 2017
	Reference Books
1	Safety, Health, and Environmental Auditing" by Simon Watson, 2nd Edition, 2016
2	Engineering Maintenance Management" by Anthony Kelly, 4th Edition, 2018
3	Industrial Safety and Hazard Management" by John Ridley, 3rd Edition, 2019
4	Lubrication and Wear of Materials" by A. Cameron, 2nd Edition, 2015
5	Preventive Maintenance Strategies" by P. K. Mishra, 1st Edition, 2017
6	Handbook of Fire and Safety Engineering" by G. W. Stout, 2nd Edition, 2016
	Useful Websites
1	http://www.osha.gov – Articles, standards, and guidelines on workplace safety.
2	http://www.indiansafety.com – Safety practices, industrial accident studies, and training resources in India.
3	http://www.iosh.co.uk – Resources and courses on occupational safety and health.
4	http://www.nsc.org – Safety research, tips, and accident prevention techniques.
5	http://www.maintenancetechnology.com – Best practices and case studies on industrial maintenance.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	1	1	1	1	1	-
CO2	3	2	2	2	2	1	1	1	1	1	1	1
CO3	3	3	3	2	2	2	1	-	1	-	1	1
CO4	3	3	2	2	3	2	1	-	1	-	1	-
CO5	3	3	3	3	3	2	-	-	1	1	1	-
CO6	3	3	3	3	3	2	-	-	1	1	1	1

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTLC206: Structural Design Lab

Teaching Scheme		Examination Scheme	
Lectures	----	ISE	----
Practical	04 Hrs./week	ESE	----
Total Credits	02	TW	25
		POE	25

Course Objectives (CO)

1. To develop proficiency in using advanced structural analysis and design software
2. To help students model, analyze, and design various structural elements and systems.
3. To understand and apply boundary conditions, loads, and structural behavior through software tools
4. To bridge the gap between theoretical knowledge and practical software applications in structural engineering

	Course Contents	Hours
Stage A	**Introduction to Structural Software Tools** • Overview and interface of tools like **STAAD Pro**, **ETABS**, **SAP2000**, **SAFE**, **ANSYS**, **MIDAS**, etc. • Basic modelling and settings	06
Stage B	**Structural Modelling and Load Application** • Modelling of 2D/3D frames and trusses • Assigning loads (DL, LL, WL, EQ loads as per IS 875 and IS 1893) • Load combinations and envelopes	06
Stage C	**Analysis of Structural Elements** • Static and dynamic analysis • Modal and response spectrum analysis • Load path understanding and deflection checks	06
Stage D	**Structural Design** • Design of beams, slabs, columns, and footings using **ETABS** or **STAAD Pro** • Reinforcement detailing output	06
Stage E	**Steel Structure Design** • Design of industrial steel frames using IS 800 • Purlin, truss, gantry girder design and detailing	06
Stage F	**Report Generation and Documentation** • Structural analysis and design report generation • Export of drawings, reinforcement schedules, and summary sheets	06

Course Outcomes (CO): At the end of course, students will able to

1	Understand the working principles and user interface of structural engineering software
2	Model and apply loads accurately to structural systems using software tools
3	Perform structural analysis (static and dynamic) for various configurations

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY Autonomous Warananagar

4	Design reinforced concrete and steel structures as per relevant IS codes
5	Interpret software output including deflections, forces, and reinforcement details
6	Generate technical reports and documentation for professional use

Text Books	
1	Structural Analysis and Design Using STAAD Pro. – T.S. Sarma, S. Chand Publishing
2	ETABS Training Manual – CSI Documentation, Computers & Structures Inc
3	Design of Steel Structures – Subramanian N., Oxford University Press
4	Design of Reinforced Concrete Structures – N. Krishna Raju, CBS Publishers
5	SAP2000 Structural Analysis Manual – CSI, Software Documentation
Reference Books	
1	Advanced Reinforced Concrete Design – P.C. Varghese, PHI Learning
2	Finite Element Analysis – S.S. Bhavikatti, New Age International
3	Structural Engineering Handbook – Edwin Gaylord, McGraw-Hill
4	Design Aids for IS 456 and IS 800 – Bureau of Indian Standards
5	Manual of Civil Engineering Software Applications – N.K. Mehta, Khanna Publishers
Useful Websites	
1	https://www.csiamerica.com – Official site for ETABS, SAP2000, SAFE
2	https://www.bentley.com – STAAD. Pro official tutorials and support
3	https://nptel.ac.in – Free structural analysis and software-based courses
4	https://theconstructor.org – Tutorials on modeling and design
5	https://civilera.com – Practical structural software examples and case studies

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	–	–	–	–	–	–	2	–
CO2	3	2	3	–	–	–	–	–	–	–	2	–
CO3	3	3	3	2	3	–	–	–	–	–	2	2
CO4	3	3	3	2	3	–	–	–	–	–	3	2
CO5	2	3	3	2	2	–	–	–	–	–	2	2
CO6	2	–	–	–	2	–	–	–	–	2	2	2

Tatyasaheb Kore Institute of Engineering & Technology, Warananagar

First Year MTech Civil (Structural Engineering) Semester- II

2501PCSTSW207: Seminar-II

Teaching Scheme		Examination Scheme	
Lectures	----	**ISE**	----
Practical	02 Hrs./week	**ESE**	----
Total Credits	01	**TW**	50
		POE	---

Course Objectives (CO)

1. To enable students to explore and review literature on emerging and advanced topics relevant to structural engineering
2. To train students in identifying research gaps, comparing methodologies, and critically analyzing published work
3. To develop skills in preparing high-quality technical documents using IEEE format
4. To enhance oral communication and confidence through formal presentation and interactive discussion

	Course Contents	Hours
Stage A	**Topic Selection** • Should reflect recent developments in: Earthquake-resistant structures High-performance concrete & smart materials Bridge, tall building, or offshore structure design Structural health monitoring and retrofitting FEM and advanced modelling techniques Green buildings and sustainability in structures Performance-based design AI/ML in structural diagnostics	08
Stage B	**Literature Study** • At least **15–20 research papers** (indexed in Scopus, SCI, IEEE, ASCE, etc.) • Compare: Approaches used Techniques/methodologies Experimental & analytical outcomes Scope for improvement and innovation	08
Stage C	**Seminar Report** • 25–30 pages on A4 sheets • Written in **IEEE format** • Content: Abstract, Introduction, Review, Analysis, Gap Identification, Conclusion, References • Must include diagrams, flowcharts, and graphical interpretations (if applicable) • Should demonstrate originality (minimum 70% unique work)	08
Stage D	**Oral Presentation** • 10–15 minutes PPT followed by Q&A • Presented in front of a departmental faculty panel and peers • Evaluation based on:	08

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY Autonomous Warananagar

	Content quality Technical understanding Clarity of presentation Participation and attendance	

Course Outcomes (CO): At the end of course, students will able to	
1	Identify a research problem aligned with structural engineering and dissertation objectives
2	Perform critical analysis of literature using research databases and scholarly articles
3	Evaluate and compare different techniques, tools, and results used by
4	Document the findings in IEEE format, showing clarity, coherence, and professionalism
5	Confidently deliver a seminar presentation using modern visual tools
6	Demonstrate the ability to respond to queries and defend the chosen topic during discussions

Text Books	
1	Scientific Writing and Communication – Angelika H. Hofmann, Oxford University Press
2	Technical Communication: Principles and Practice – Meenakshi Raman & Sangeeta Sharma, Oxford University Press
3	Research Methodology – Ranjit Kumar, SAGE Publications
4	Advanced Concrete Technology – Zongjin Li, Wiley-Blackwell

Reference Books	
1	Research Methodology: Methods and Techniques – C.R. Kothari & Gaurav Garg, New Age International
2	Earthquake Resistant Design of Structures – Pankaj Agarwal & Manish Shrikhande, PHI Learning
3	Structural Engineering Handbook – Edwin H. Gaylord & Charles Gaylord, McGraw-Hill
4	Structural Analysis: A Unified Classical and Matrix Approach – Amin Ghali et al., CRC Press

Useful Websites	
1	https://ascelibrary.org – ASCE journals and recent research
2	https://sciencedirect.com – Peer-reviewed articles and case studies
3	https://ieeexplore.ieee.org – IEEE paper formats and examples
4	https://researchgate.net – Author profiles, free papers, and discussions

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	–	–	–	–	–	–	2	–
CO2	3	3	2	2	–	–	–	–	–	–	3	1
CO3	3	3	3	2	2	–	–	–	–	–	3	2
CO4	3	2	2	2	–	–	–	–	–	2	3	2
CO5	2	–	–	–	–	–	–	–	2	3	3	–
CO6	2	2	–	–	–	–	–	–	2	3	3	1

Note:

1. Students have to opt for **any one elective** from the respective **Elective I, II, III, IV, and V** bucket lists.
2. The **Open Elective** subject must be opted from the **provided bucket list** (subjects offered by other departments).
3. Students must select **one Open Elective** from **any branch other than Structural Engineering** (the admitted branch).

Secretary BOS
Dept. of Civil Engg.

Chairman BOS
Dept. of Civil Engg.

PG Coordinator
TKIET Warananagar

Dean Academics
TKIET Warananagar

TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY
Autonomous
Warananagar

Principal
TKIET Warananagar
Chairman Academic Council