Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Master of Technology

SoE & Syllabus 20**23**

(Department of Civil Engineering)

M.Tech in Structural Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. 23STR-101

M.TECH. SCHEME OF EXAMINATION 2023

M.Tech. in Structural Engineering

SN	Sem	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage		ESE Duration Hours
					L	T	P	Hrs		TA**	ESE	
I SEMESTER												
1	1	23STR101	Theory of Elasticity & Elastic Stability	T	**3**	0	0	3	3	20	80	3
2	1	23STR102	Structural Dynamics	T	**3**	0	0	3	3	20	80	3
3	1	23STR103	**Lab. :** Structural Dynamics	P	**0**	0	2	2	1	60	40	-
4	1	23STR104	Matrix Analysis of Structures	T	**3**	0	0	3	3	20	80	3
5	1	23STR105	**Lab. :** Matrix Analysis of Structures	P	**0**	0	2	2	1	60	40	-
6	1	23STR106	Design of Substructures & Foundations	T	**3**	0	0	3	3	20	80	3
7	1	23STR107	Earthquake & Wind Effects on Structures	T	**3**	0	0	3	3	20	80	3
8	1	23STR108	Advanced Concrete Structures	T	**3**	0	0	3	3	20	80	3
9	1	23STR109	**Lab. :** RCC Design Studio	P	**0**	0	2	2	1	60	40	-
Total					**18**	**0**	**6**	**24**	**21**			
II SEMESTER												
1	2	23STR201	Finite Element Method	T	3	0	0	3	3	20	80	3
2	2	23STR202	**Lab. :** Finite Element Method	**P**	0	0	2	2	1	60	40	-
3	2	23STR203	Prestressed Concrete	T	3	0	0	3	3	20	80	3
4	2	23STR204	Advanced Steel Structures	T	3	0	0	3	3	20	80	4
5	2	23STR205	**Lab. :** Steel Design Studio	**P**	0	0	2	2	1	60	40	-
6	2		**Professional Elective-I**	T	3	0	0	3	3	20	80	3
7	2		**Professional Elective-II**	T	3	0	0	3	3	20	80	3
8	2		**Professional Elective-III**	T	3	0	0	3	3	20	80	3
Total					**18**	**0**	**4**	**22**	**20**			

Professional Elective - I

1	2	23STR211	**PE I :** New Engineering Materials									
2	2	23STR212	**PE I :** Theory of Plates & Shells									
3	2	23STR213	**PE I :** Smart Structures & Applications									

Professional Elective - II

1	2	23STR231	**PE II :** RC Tall Buildings									
2	2	23STR232	**PE II :** Composite Structures									
3	2	23STR233	**PE II :** RC Bridge Design									

Professional Elective - III

1	2	23STR241	**PE III :** Plastic Analysis & Design of Steel Structures									
2	2	23STR242	**PE III :** Seismic Analysis & Design of Structures									
3	2	23STR243	**PE III :** Design of Industrial Structures									
III SEMESTER												
1	3	23STR301	Project Phase-I	**P**	0	0	16	16	8	60	40	-
Total					**0**	**0**	**16**	**16**	**8**			
IV SEMESTER												
1	4	23STR401	Project Phase-II	**P**	0	0	24	24	12	60	40	-
Total					**0**	**0**	**24**	**24**	**12**			

GRAND TOTAL			**61**

		June, 2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

I Semester

23STR101– Theory of Elasticity & Elastic Stability

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Demonstrate the knowledge of fundamental methods of elasticity for 2-D and 3D stress analysis
2. Analyze bending and torsional problems and apprise various theories to solve 2-D problems
3. Apply the basic knowledge of elastic stability to various structural elements
4. Explain and solve the problems of beam-column, column and built up column using the concept of elastic stability.

Unit:1	Two Dimensional Stress Analysis	**7 Hours**

Introduction to Two Dimensional Stress Analysis, Types of forces, Components of stresses and strains, Stress-strain relation, Plane stress and plane strain, Strain at a point, Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress function.
(Contemporary issues related to topic)

Unit:2	Three Dimensional Stress Analysis	**6 Hours**

Introduction to Three Dimensional Stress Analysis, Components of stress, Principal stresses, Stress invariants, Maximum shearing stress, Differential equation of equilibrium, Boundary conditions and compatibility equations.
(Contemporary issues related to topic)

Unit:3	Bending of cantilever	**6 Hours**

Bending of cantilever of narrow rectangular section loaded at end, bending of simply supported beam with uniform load, torsion of non-circular and elliptical cross section.
(Contemporary issues related to topic)

Unit:4	Beams columns	**7 Hours**

Differential equation for beams columns with concentrated loads, continuous lateral loads and couples for simply supported ends, Application of trigonometric series, Lateral buckling of beams.
(Contemporary issues related to topic)

Unit :5	Elastic bucking of columns	**7 Hours**

Energy method for elastic bucking of columns, Approximate method, Buckling of Columns on elastic foundation, Columns with intermediate compressive forces and distributed axial load, Columns with varying cross section.
Contemporary Issues related to Topic

Unit :6	**Buckling of built up columns**	**6 Hours**

Effect of shearing force on critical load, Buckling of built up columns, Buckling of simply supported rectangular plates uniformly compressed in middle plane.
(Contemporary issues related to topic)

	Total Lecture	**39 Hours**

Text Books	
1.	Timoshenko, S.P. and Goodier, J.N., Theory of Elasticity, 3rd Edition, Mc-Graw Hill Book Company, New Delhi, 1963
2.	Timoshenko, S.P. and Gere J. M., Theory of Elastic Stability , 2nd Edition, Mc-Graw Hill Book Company, New Delhi,1963
3.	Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley

Reference Books	
1	Srinath, L.S., Advanced Mechanics of Solids India, 2nd Edition, Tata Mc-Graw Hill Book Company, 2003.
2	Ameen, M., Computational Elasticity—Theory of Elasticity, Finite and Boundary Element Methods, 1st Edition, Narosa publication, 2007
	Mikhait Filonenkoborodich, Theory of Elasticity, 1st Edition, University press of pacific, 2003

YCCE e - library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/

MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in/courses/105/105/105105177/

I Semester
23STR102– Structural Dynamics

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Relate the importance of vibratory structure with respect to safety and reliability of engineering systems. 2. Analyze problems having undamped and damped vibrations. 3. Analyze problems having forced vibrations. 4. Implement codal provisions related to earthquake loading.

Unit:1	**Elements of Vibration.**	**7 Hours**
Basic Concepts of vibrations, Dynamic loading. Causes of Dynamic effect. Fundamentals of Rigid / Deformable body dynamics, Natural frequency and time period, Formation of Equation of Motion, Types of Vibration, Equivalent stiffness of spring combination.. **(Contemporary issues related to topic)**		
Unit:2	**Damped and Undamped free vibration of SDOF system**	**7 Hours**
Equation of motion, Analysis of undamped single degree freedom systems. Types of Damping, Measurement of Damping, Analysis of damped single degree freedom systems. **(Contemporary issues related to topic)**		
Unit:3	**Forced vibration of SDOF system**	**6 Hours**
Response of single degree freedom systems to harmonic loading, support motion and transmissibility, Response of single degree freedom systems to periodic loading. Fourier series and Analysis. Duhamels Integral(Impulsive loading) **(Contemporary issues related to topic)**		
Unit:4	**Vibration of multiple-degree of freedom system**	**7Hours**
Multiple degree of Freedom system: Vibration of undamped 2 DOF systems; Response of 2 DOF to harmonic excitation, mode superposition, vibration absorber, Free vibration of MDOF (up to 3 DOF) systems, Dynamic response of MDOF (2 DOF) systems-modal superposition method. Energy Principle, Rayleigh's method (2 DOF) **(Contemporary issues related to topic)**		
Unit:5	**Longitudnal, Transverse and Torsional Vibration.**	**7 Hours**
Dynamic analysis of systems with distributed properties, Approximate design method, Transformation factors. Vibration of Continuous Systems: Free vibrations of Continuous systems-axial and transverse vibration of bars / beams. Response of continuous systems to dynamic load. **(Contemporary issues related to topic)**		
Unit :6	**Elements of Seismology**	**7 Hours**
Introduction to vibrations due to earthquake, Codal Provision for Seismic analysis as per IS 1893 applicable to Buildings and Water Tanks. **(Contemporary issues related to topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Mario Paz, Structural Dynamics Theory & Application, CBS Publ.; N-Delhi, 1995.
2	Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition., Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995

Reference Books	
1	Clough / Penzien, "Dynamics of Structures", McGraw Hill, 1993
2	Humar, J. L., "Dynamics of Structures", Prentice Hall, 1993
3	Timoshenko, S., "Advanced Dynamics", McGraw Hill Book Co; NY, 1948
4	Damodarasamy and Kavitha," Basics of structural Dyanamics and Aseismic design, Phi Publisher, New Delhi.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105106151

I Semester

23STR103– Lab. : Structural Dynamics

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Relate the importance of vibratory structure with respect to safety and reliability of engineering systems.
2. Analyze problems having undamped and damped vibrations.
3. Analyze problems having forced vibrations.
4. Implement codal provisions related to earthquake loading.

S.N.	Experiments based on
1	Study of the Instruments used in Structural Dynamics
2	To determine damping ratio & damped frequency
3	To study the response of single degree of freedom system and to find out the natural frequency.
4	To study the Soil liquefaction
5	Earthquake induced waves in rectangular water tanks
6	Evaluation of damping at Resonance.
7	Determining natural frequency and drawing mode shapes of a three degree freedom shear building model.
8	To calculate the lateral force in water tank due to earthquake when water tank is empty and water tank is full by 1893:2002
9	To calculate the horizontal seismic forces at all levels of the building using IS 1893:2002 (part-I)
10	Dynamics of a vibration absorber
11	Dynamics of one-span and two-span beams

I Semester

23STR104 – Matrix Analysis of Structures

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Understand the different types of structures 2. Apply the matrix stiffness method to model the behavior of planar trusses, beams, and frames; 3. Analyze any multistoried building using Matrix Stiffness methods of structural analysis. 4. Recognize special effects on behavior of structures. 5. Implement the method developing their own computer program to analyze structures.

Unit:1	**Basics of Stiffness Method**	**7 Hours**
Introduction to stiffness and flexibility approach, Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Global stiffness matrix and load vectors, Assembly of structure stiffness matrix with structural load vector, application to spring and bar problems. **(Contemporary Issues related to Topic)**		
Unit:2	**Analysis of Trusses**	**6 Hours**
Analysis of Plane Truss, Space Truss by Stiffness Method **(Contemporary Issues related to Topic)**		
Unit:3	**Analysis of Beams and Frames**	**6 Hours**
Analysis of Beam, Plane Frame, Space Frame by Stiffness Method **(Contemporary Issues related to Topic)**		
Unit:4	**Analysis of Building Systems with Horizontal Loads**	**6 Hours**
Analysis of building systems for horizontal loads, Buildings with and without rigid diaphragm, various mathematical models, and introduction to Solution techniques. **(Contemporary Issues related to Topic)**		
Unit:5	**Analysis of Grid:**	**7 Hours**
Analysis of Plane Grid by Stiffness Method **(Contemporary Issues related to Topic)**		
Unit :6	**Analysis using special effects on structure**	**7 Hours**
Analysis for member loading (self, Temperature & Imposed) Inclined supports, Lack of Fit, Initial joint displacements. Effect of shear deformation, internal member end releases **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Matrix Method of Structural Analysis, Gere, W. and Weaver; J. M., 3rd Edition, Van Nostrand Reinhold; New York; 1990
2	Matrix Method of Structural Analysis, Meghre A.S.& Deshmukh S.K. ; 1st edition, Charotar publishing house, Anand, 2003
3	Matrix Method of Structural Analysis, Kanchi, M. B., 2nd Edition; John Willey & Sons, 1999
4	Matrix Methods of Structural Analysis, Godbole P., Sonparote R., Dhote S., PHI Learning Pvt. Ltd. 2014

Reference Books	
1	Matrix Analysis of Structural Dynamics, Cheng, F.Y., M. Dekke; NY 2000
2	Finite Element Procedures, Bathe, K.J., 2nd Edition Springer,; 2002
3	Concepts and Applications of Finite Element Analysis, Cook, R.D. et. al, John Willey &Sons; NY 1995
4	Introduction to Matrix Method of Structural Analysis, Martin; H.C., McGraw Hill Book Co. 1966
5	Introduction to Finite Elements in Engineering, Chandrapatla T.R., Belegundu A., D. Prentice Hall India, 1991
6	Matrix Analysis of Structures SI Version, Kassimali A., Cengage Learning, 2011
7	Matrix Methods of Structural Analysis: Livesley R. K. Pergamon International Library of Science, Technology, Engineering and Social Studies, Elsevier, 2013
8	Matrix Structure Analysis. McGuire W. Gallaghar R. H. & Zimian R. D., John Willey Publication
9	Theory of Matrix Structural Analysis, Przemieniecki J. S., Dover Publication Inc. New York

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/20.%20Matrix%20methods%20of%20structural%20analysis%20(%20PDFDrive%20)-ebook.pdf

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_ce71/preview

I Semester

23STR105 – Lab: Matrix Analysis of Structures

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Apply the stiffness method for structural analysis. 2. Analyze continuous beams, plane truss, space truss, plane frame neglecting axial deformation, plane frame considering axial deformation, plane grids. 3. Recognize special effects on behavior structures.

S.N.	Experiments based on
1	Analyze a continuous beam with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
2	Analyze a continuous beam with sinking of support with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
3	Analyze a plane truss with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method. Conclude it from both the result.
4	Analyze a plane truss subjected to inclined roller support with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
5	Analyze a plane truss subjected to temperature effect and lack of fit with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
6	Analyze a space truss with maximum three degree of Kinematic Indeterminacy using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
7	Analyze a plane frame with maximum three degree of Kinematic Indeterminacy, using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
8	Analyze a plane grid using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
9	Analyze a multi storied frame structure subjected to horizontal forces using software package.

I Semester
23STR106 – Design of Substructures & Foundations

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Identify the suitable foundations system for various site conditions. 2. Apply the codal provisions for designing different types of foundation structures. 3. Explain the various methods of ground improvement techniques. 4. Analyze and design the different types of foundation structures.

Unit:1	**Soil Structure interaction**	**7 Hours**
Introduction to soil structure interaction, Bearing Capacity of Foundations, Theories, In-situ tests; Settlement Analysis, factors affecting settlement, control of excessive settlements; Soil classification, Geotechnical design parameters. Design of different isolated footings including eccentrically loaded footings. **(Contemporary Issues related to Topic)**		
Unit:2	**Combined and Raft foundation**	**6 Hours**
Design of combined footing and design of raft foundation. **(Contemporary Issues related to Topic)**		
Unit:3	**Pile Foundation**	**7 Hours**
Analysis and design of pile foundation, Function and Classification of piles, Static point and skin resistance capacity of a Pile, pile load tests, Pile settlements, design of RCC piles, Various pile group patterns, Efficiency of Pile in group, Negative skin friction, Pile Cap design, Under reamed pile foundation, Introduction to design of well foundation. IS 2911 Part I to Part V **(Contemporary Issues related to Topic)**		
Unit:4	**Machine foundations**	**6 Hours**
Introduction to machine foundations and its practical considerations for construction IS code of practice, introduction to analysis and design of simple machine foundation. Theory of sub grade reaction, beam on elastic foundation. **(Contemporary Issues related to Topic)**		
Unit:5	**Ground improvements**	**6 Hours**
Ground improvements: Various methods, sand drains, stone columns, stabilization, grouting, reinforced earth, geotextiles, diaphragm walls, Reinforced earth retaining walls, skin walls. **(Contemporary Issues related to Topic)**		
Unit :6	**Retaining wall and abutments**	**7 Hours**
Analysis and design of Cantilever, counter fort and basement retaining walls and abutments. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Sawmi Saran, Analysis and Design of Substructures, Oxford & IBH Publishing Co Pvt.Ltd; 2nd edition 2018
2	Kurain N. P, Design of foundation systems- Principles and Practice, Alpha Science International Ltd, 3rd edition, 2005
3	Karuna Moy Ghosh, Foundation Design in practice, PHI Learning Pvt. Ltd, New Delhi 2012
4	P. C. Varghese, Design of Reinforced Concrete Foundations, PHI Learning Pvt. Ltd., New Delhi, 2009.

Reference Books	
1	Kurain N.P, Modern Foundations: Introduction to Advance Techniques, Tata McGraw Hill, 1982
2	Winterkorn, H.F and Fang, Y.F., Foundation Engineering Handbook, Van Nostrand Reinhold, 1994.
3	Sreenivasalu & Varadarajan, Handbook of Machine Foundations, Tata McGraw Hill
4	Swami Saran, Soil Dynamics and machine Foundations, Galgotia Publications Pvt. Ltd., Third Edition, 2016

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-540-32894-0

MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/105/105/105105207/
2	https://archive.nptel.ac.in/courses/105/105/105105176/

I Semester
23STR107 – Earthquake & Wind Effects on Structures

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Understand geological feature, and plate tectonics in occurrence of earthquake. 2. Explain causes and sources of earthquake damages and possible response of structure 3. Analyze characteristics of wind and its static and dynamic effects on structures 4. Implement relevant I.S. codes in design of earthquake & Wind resistant structure

Unit:1	**Introduction to Earthquake**	**7 Hours**
Origin of earthquake, Engineering geology of earthquakes, faults, Propagation of earthquake waves, quantification of earthquake (magnitude, & intensity of earthquake), Measurement of earthquake (accelerograph, accelogram recording and analysis of earthquake records), determination of magnitude, epicenter distances, Seismicity of the world. **(Contemporary Issues related to Topic)**		
Unit:2	**Sources of Earthquake**	**6 Hours**
Causes or sources of earthquake damage, damage due to ground failure, History of past Earthquakes, generation of response spectrum from available earthquake records, Earthquake design spectrum and inelastic spectrum. Evolution of seismic risk. **(Contemporary Issues related to Topic)**		
Unit:3	**Design philosophy and study of IS code**	**7 Hours**
Concepts of earthquake resistance design, Design philosophy, and four virtues of earthquake resistance design (stiffness, strength, ductility and configuration). Introduction to capacity design concept, Study of IS: 1893, Study of IS: 13920 for analysis and ductile design of RCC structures. **(Contemporary Issues related to Topic)**		
Unit:4	**Wind Characteristics**	**7 Hours**
Wind Characteristics: Historical Wind Speed Data, Wind Speed Map of India, Cyclones and Tornadoes **(Contemporary Issues related to Topic)**		
Unit:5	**Study of IS – 875 (Part III)**	**6 Hours**
Static Wind effects and Building Codes with particular reference to IS – 875 (Part III). **(Contemporary Issues related to Topic)**		
Unit :6	**Dynamic Wind Effects**	**6 Hours**
Dynamic Wind Effects: Wind Induced Vibrations, Analysis for dynamic wind loads, Vibration Control and Structural Health Monitoring. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Kramer, S.L, "Geotechnical Earthquake Engineering", Prentice Hall, New Jersey, 1996.
2	Arya A. S., "Introduction to earthquake engineering structures".
3	C. Scruton, "An Introduction to Wind Effects on Structures", Oxford University Press, Oxford, UK., 1981

Reference Books	
1	Murthy, C.V.R, "Earthquake tips", IIT Kanpur documents.
2	Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition., Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995
3	Dowrick, D.J, "Earthquake Resistant Design for Engineers and Architects", 2nd Edition; 1987
4	Peter Sachs, "Wind Forces in Engineering", Pergamon Press. Oxford UK, 1972
5	Lawson T. V., "Wind Effects on Buildings", Applied Science Publishers, London, UK, 1980
6	Emil Simiu and R. H. Scanlan, "Wind Effects on Structures – An Introduction to Wind Engineering", John Wiley and Sons, New York., 1986

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	ttp://link.springer.com/openurl?genre=book&isbn=978-3-319-01025-0
2	http://link.springer.com/openurl?genre=book&isbn=978-94-007-6572-6

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105101004
2	https://nptel.ac.in/courses/105102016
3	https://nptel.ac.in/courses/105108074

I Semester
23STR108 – Advanced Concrete Structures

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Comprehend the structure's configuration (including its components, civil and structural engineering drawings, etc.) 2. Apply the provisions of related IS codes for design of concrete structures. 3. Understand how natural occurrences like wind and earthquakes affect structural engineering 4. Analyze and design advanced reinforced concrete structure such as Multistoried buildings, water tanks, bridge deck slab, bunkers, and silos

Unit:1	**Multistoried buildings**	**7 Hours**
Analysis and design of Multistoried buildings, calculation of loads, Approximate analysis, Preliminary sizing, **(Contemporary Issues related to Topic)**		

Unit:2	**Circular water tanks**	**6 Hours**
Introduction: Permissible stresses in concrete, permissible stresses in steel, minimum reinforcement, minimum cover. **Analysis and Design of Dome:** Introduction, Meridional thrust, Hoop thrust. **Circular water tank:** Circular tank with a flexible joint between floor and wall, circular tank with a rigid joint between floor and wall, Design of circular tanks using approximate method and IS code method. **(Contemporary Issues related to Topic)**		

Unit:3	**Elevated water tank**	**7 Hours**
Introduction, Analysis and Design of Elevated water tank including design of supporting system **(Contemporary Issues related to Topic)**		

Unit:4	**Standard specification and code of practice for bridges**	**6 Hours**
Introduction of the Indian Roads Congress (IRC) bridge code, IRC sections, Evolution of Standard Loading for Design of Bridges. **IRC 6:** Introduction of IRC 6, classification of IRC loading, Loads forces and Stresses, Impact factor, Width of carriage way, minimum clearance, ground contact area of the wheels. **IRC 21:** Introduction of IRC 21, guidelines, materials, permissible stresses, effective width of slab, Dispersion of wheel Loads on slab. **(Contemporary Issues related to Topic)**		

Unit:5	**Design of deck slab**	**7 Hours**
Analysis, Design of bridge deck slab and Culverts. **(Contemporary Issues related to Topic)**		

Unit :6	**Silos, and Bunkers**	**6 Hours**
Introduction, Rankine's Theory, Janssen's Theory, Airys Theory, analysis and design of silos and bunkers **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1.	Bhavikatti S. S., "Advanced R. C. C. Design", Volume-II, New age international publisher, New Delhi.
2.	Krishna Raju N, "Advanced R. C. C. Design", CSB Publisher and Distributor, New Delhi.
3.	Ramaswamy, G.S, "Design of Concrete Shells", Krieger Publisher and Co.

Reference Books:	
1.	Johnson and Victor, "Essentials of Bridge Engineering", Oxford and IBH publisher.
2.	Jain O.P. and Jai Krishna, "Plain and Reinforced concrete structures", Volume II, Nemchand and brothers, 1987
3.	Chattergee, B K, "Theory and design of Concrete Shells", Oxford and IBH publisher.
4.	Chen, W.F. and Duan, L. "Bridge engineering Handbook".
5.	IS 456 : 2000, "Plain and Reinforced Concrete - Code of Practice", Bureau of Indian Standards (BIS), New Delhi, India.
6.	IS 3370 : 2009, "Concrete Structures for Storage of Liquids - Code of Practice", Bureau of Indian Standards (BIS), New Delhi, India.
7.	SP 16 (1980), "Design Aids for Reinforced Concrete to IS 456", Bureau of Indian Standards (BIS), New Delhi, India.
8.	SP 34 (1987), "Handbook on - Concrete Reinforcement and. Detailing", Bureau of Indian Standards (BIS), New Delhi, India.
9.	IRC 6, "Standard specification, and code of practice - for bridges", Section-II, Loads and Stresses, Indian Road Congress, New Delhi, India.
10.	IRC 21, "Standard specification, and code of practice for bridges", Section-III, Cement Concrete (Plain and Reinforced), Indian Road Congress, New Delhi, India.

YCCE e- library book links [Accessible from college campus]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-211-82919-6
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/12.%20REINFORCED%20CONCRETE%20DESIGN%20-%20N.KRISHNA%20RAJU.pdf
3	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/11.%20Design%20of%20Concrete%20Structures,%2013th%20Edition%20-%20(Malestrom).pdf

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/105105105

I Semester

23STR109 – Lab. : RCC Design Studio

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Developed the models, add the loads, apply the member characteristics, and create the boundary condition in the software program.
2. Analyze and design the RCC structural elements in the software applications by applying relevant IS code.
3. Analyze and design advanced reinforced concrete structure such as Multistoried buildings, water tanks.
4. Compare and contrast the results of the hand calculation with those of the software package.

SN	Assignment based on
1.	Review of IS 456
2.	Review of SP16
3.	Review of SP34
Minimum THREE Practical's to be performed from the list as below	
4.	Using a software application, **analyse and design a continuous beam**. Compare the design outputs of software applications with those of manual calculations.
5.	Using a software application, **analyse and design of frame (one bay and one floor).** Compare the design outputs of software applications with those of manual calculations.
6.	Using a software application, **design the Isolated footing of the frame (one bay and one floor).** Compare the design outputs of software applications with those of manual calculations.
7.	Using a software application, **analyse and design of multistoried frame (Maximum upto Three bay and four floor).** subjected to dead load, live load and wind load.
8.	Using a software application, **analyse and design of elevated RCC rectangular water tank** subjected to dead load, live load, hydrostatic load and wind load.

Reference Books:	
1.	IS 456 : 2000, "Plain and Reinforced Concrete - Code of Practice", Bureau of Indian Standards (BIS), New Delhi, India.
2.	IS 3370 : 2009, "Concrete Structures for Storage of Liquids - Code of Practice", Bureau of Indian Standards (BIS), New Delhi, India.
3.	SP 16 (1980), "Design Aids for Reinforced Concrete to IS 456", Bureau of Indian Standards (BIS), New Delhi, India.
4.	SP 34 (1987), "Handbook on Concrete Reinforcement and. Detailing", Bureau of Indian Standards (BIS), New Delhi, India.
5.	SP 43 (1987), "Handbook on Structures with reinforced concrete portal frames (without cranes)", Bureau of Indian Standards (BIS), New Delhi, India.
6.	SP 64, "Explanatory Handbook on Indian Standard code of practice for design loads (other than earthquake) for Buildings and Structures", Part-III, Wind Loads, Bureau of Indian Standards (BIS), New Delhi, India.

II Semester
23STR201– Finite Element Method

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Explain basic concepts of finite element method. 2. Apply concepts of FEM for derivation of element equations. 3. Analyze civil engineering problems by finite element method. 4. Explain mathematical modeling and solution techniques in FEM

Unit:1	**Introduction**	**7 Hours**
Principles and discretization, Elements stiffness formulation based on variational techniques, Rayleigh Ritz Method for Bar and Beam analysis. Convergence criteria **(Contemporary Issues related to Topic)**		
Unit:2	**Application of FEM to 1D Problems**	**6 Hours**
Shape functions, Formulation of stiffness matrices and load vectors, Assembling, Application of FEM to bar and beam Problems. **(Contemporary Issues related to Topic)**		
Unit:3	**Application of FEM to 2D problems**	**7 Hours**
Application of FEM to 2D problems: Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis. **(Contemporary Issues related to Topic)**		
Unit:4	**Isoparametric elements**	**6 Hours**
Isoparametric elements, Natural coordinates, Application to 1D and 2D Problems. **(Contemporary Issues related to Topic)**		
Unit:5	**Application of FEM to 3D problems**	**7 Hours**
Shape Functions for Three Dimensional Stress analysis, Axi-symmetric Stress Analysis. **(Contemporary Issues related to Topic)**		
Unit :6	**Modelling techniques**	**6 Hours**
Numerical integration, Modelling and storage techniques, Introduction to standard FEM software. **Contemporary Issues related to Topic:** One issue is the need to simulate damage and failure, with the final goal to estimate lifetime of a structure. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Chandrapatla T.R., Belegundu A. D., *Introduction to Finite Elements in Engineering*, Prentice Hall India,1991
2	Godbole P. N., Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013

Reference Books	
1	Desai Y. M., Eldho T. I., Shah A. H., Finite Element Method with Application in Engineering, Dorling Kindersley (India) Pvt. Ltd, New Delhi , 2011
2	Cook R. D., Concepts and Applications of Finite Element Analysis, 3rd Edition, Wiley India Text books, Wiley India Pvt Limited, New Delhi , 1989
3	Rajasekaran S., *Finite Element Analysis in Engineering Design*, S. Chand & Co. Ltd. New Delhi, 1999.
4	A.S. Meghre, Ms. K.M. Kadam, Finite Element Method in Structural Analysis, Khanna Publishers, New Delhi , 2014

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-540-76342-0
2	http://link.springer.com/openurl?genre=book&isbn=978-3-211-81202-0

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105105041
2	https://nptel.ac.in/courses/105107209

II Semester

23STR202– Lab. : Finite Element Method

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Explain basic concepts of finite element method.
2. Apply concepts of FEM for derivation of element equations.
3. Analyze civil engineering problems by finite element method.
4. Explain mathematical modeling and solution techniques in FEM

S.N.	Experiments based on
1	Analysis of 2D truss
2	Analysis of Bar subjected to various loading conditions
3	Analysis of beam subjected to various loading conditions
4	Analysis of Plane Stress problem (Plate, Plate with hole) using triangular & Quadrilateral element
5	Analysis of Plain Strain problem (Retaining wall, Culvert) using triangular & Quadrilateral element
6	Analysis of Axisymmetric problem (Cylinder, foundation) using triangular & Quadrilateral element
7	Analysis of 3D beams (Cantilever and Simply Supported) subjected to various loading conditions

II Semester
23STR203– Prestressed Concrete

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Explain the basic concepts of Prestressed concrete. 2. Apply the various codal provisions related to Prestressed concrete. 3. Analyze the Prestressed concrete structural members. 4. Design the Prestressed concrete structural members**.**

Unit:1	**Introduction to prestressed concrete**	**7 Hours**
Introduction to prestressed concrete, types of prestressing, systems and devices, materials, losses in prestress, IS1343-2012 codal provisions. Analysis of PSC flexural members, stresses at transfer and service loads. **(Contemporary Issues related to Topic)**		
Unit:2	**Analysis and design of PC Sections**	**6 Hours**
Limit state of collapse and serviceability for analysis and design of rectangular, I and box sections for flexure and shear, control of deflection. **(Contemporary Issues related to Topic)**		
Unit:3	**Trasmission of Prestressed and Statically Indeterminate Structures**	**6 Hours**
Transmission of pre-stress in pre-tensioned members and post-tensioned members. Introduction to statically indeterminate structures, redundant reactions, linear transformation and concordancy. **(Contemporary Issues related to Topic)**		
Unit:4	**Continuous Beams**	**7 Hours**
Analysis and design of continuous beams, Choice of cable profile. **(Contemporary Issues related to Topic)**		
Unit:5	**Composite Construction**	**7 Hours**
Composite construction with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage, deflection effects. Partial prestressing - principles, analysis and design concepts, crack-width calculations **(Contemporary Issues related to Topic)**		
Unit :6	**Prestressed Conctrete Slabs**	**6 Hours**
Analysis and design of prestressed concrete slabs – one way and two way Introduction to prestressed concrete pipes, tanks, flat slabs, grids, railway sleepers (No numerical problems). **(Contemporary Issues related to Topic)**		
	Total Lecture Hours	**39 Hours**

Text Books	
1	N. Krishana Raju, Prestressed Concrete, McGraw Hill Education, New Delhi.6th edition, 2018
2	Praveen Nagarajan, Prestressed Concrete Design, Pearson Education India, 1st edition, 2013
3	K.U. Muthu, Prestressed Concrete, PHI Learning, 2016
4	N. Rajagopalan, Prestressed Concrete, Alpha Science International Ltd, 2nd edition 2005

Reference Books	
1	P. Dayaratnam, Prestressed Concrete, Oxford & IBH Publishing Co Pvt.Ltd, 6th edition, 2018
2	Lin T.Y., Design of Prestressed Concrete structures, Wiley India Private Limited, 3rd edition, 2010
3	S.K. Mallick and A.P.Gupta, Prestressed concrete, Oxford and IBH Publishing Co., New Delhi
4	IS 1343: 2012 - Prestressed concrete-code of practice

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-0-412-37760-0

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105106117
2	https://archive.nptel.ac.in/courses/105/106/105106118/

II Semester
23STR204– Advanced Steel Structures

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Comprehend the structure's configuration (including its components, civil and structural engineering drawings, etc.) 2. Apply the provisions of related IS codes for design of steel structures. 3. Understand how natural occurrences like wind and earthquakes affect structural engineering 4. Analyze and design advanced steel structures including industrial sheds, crane and gantry girders, chimneys, storage vessels, truss bridges using the concepts, skills, and current codal standards.

Unit:1	**Roof Truss**	**7 Hours**
Design of roof truss of industrial structure. **(Contemporary Issues related to Topic)**		
Unit:2	**Girder**	**6 Hours**
Design of gantry girder, plate girder of industrial Structure. **(Contemporary Issues related to Topic)**		
Unit:3	**Chimney**	**7 Hours**
Design of Chimney. **(Contemporary Issues related to Topic)**		
Unit:4	**Water Tank**	**6 Hours**
Design of elevated storage tank, Design of staging **(Contemporary Issues related to Topic)**		
Unit:5	**Bunker**	**7 Hours**
Analysis and Design of Bunkers **(Contemporary Issues related to Topic)**		
Unit :6	**Truss Bridge**	**6 Hours**
Design of Truss Bridges. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1.	Duggal S.K., "Design of Steel Structures", Mc Graw Hill publication, 2007
2.	N. Krishna Raju, "Design of Bridges", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3.	Dayaratnam P., "Design of Steel Structures", Wheeler Publications, Allahabad, 1992

Reference Books:	
1.	Arya A.S and Ajmani J.L., "Design of Steel Structures", Nemchand & bross, Roorkee
2.	Ram Chandra, "Design of Steel structures", Volume I, Volume II, Standard book house, Rajsons Publication Pvt. Ltd., Delhi, 2006
3.	Gaylords, E.H. & Gaylords, C. N., "Design of Steel Structures", Blackwell.
4.	IS 800:2007, "Indian Standard, Code of Practice for General Construction in Steel", Bureau of Indian Standards, Bureau of Indian Standards (BIS), New Delhi, India.
5.	IS 875 (Part-I), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-I, Dead loads, Bureau of Indian Standards (BIS), New Delhi, India.
6.	IS 875 (Part-II), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-II, Imposed loads, Bureau of Indian Standards (BIS), New Delhi, India.
7.	IS 875 (Part-III), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-III, Wind load, Bureau of Indian Standards (BIS), New Delhi, India.
8.	IS 6533 (Part-I), "Indian Standard, Design, and construction of steel Chimney code of practice", Part-I Mechanical aspect, Bureau of Indian Standards (BIS), New Delhi, India.
9.	IS 6533 (Part-II), "Indian Standard, Design, and construction of steel Chimney code of practice", Part-II Structural aspect, Bureau of Indian Standards (BIS), New Delhi, India.
10.	SP 6 (I), "Handbook for Structural Engineers", Bureau of Indian Standards, New Delhi, India.
11.	SP 38, "Handbook of Typified Design for Structures with steel roof trusses (with and without cranes)", Bureau of Indian Standards (BIS), New Delhi, India.
12.	SP 40, "Handbook on Structures with Steel Portal Frames (without cranes)", Bureau of Indian Standards (BIS), New Delhi, India.
13.	SP 64, "Explanatory Handbook on Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures", Part-III Wind Loads, Bureau of Indian Standards (BIS), New Delhi, India.

YCCE e- library book links [Accessible from college campus]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-5864-0

MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in/courses/105/105/105105162/
2.	https://youtu.be/Om6ICuhwBo0
3.	https://www.youtube.com/watch?v=Ch2vAzvXbKI

II Semester

23STR205– Lab. : Steel Design Studio

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Developed the models, add the loads, apply the member characteristics, and create the boundary condition in the software program. 2. Analyze and design the steel structural elements in the software applications by applying relevant IS code. 3. Analyze and design steel structure such as industrial sheds, storage tanks and truss bridge. 4. Compare and contrast the results of the hand calculation with those of the software package.

SN	Assignment based on
1.	Review of IS 800:2007 Section 5: Limit State Design
2.	Review of IS 800:2007 Section 6: Design of Tension Member
3.	Review of IS 800:2007 Section 6: Design of Compression Member
4.	Review of IS 800:2007 Section 7: Design of member subjected to bending
5.	Review of IS 800:2007 section 9: Design of member subjected to combined forces
6.	Review of IS 800:2007 section 10: Design of connection
Minimum THREE Practical's to be performed from the list as below	
7.	Using a software application, **analyse and design a beam subjected to TWO moving loads on it**. Compare the design outputs of software applications with those of manual calculations.
8.	Using a software application, **analyse and design a roof truss subjected to dead load, live load and Wind load on it**. Compare the design outputs of software applications with those of manual calculations.
9.	Using a software application, **analyse and design of elevated Steel rectangular water tank subjected to dead load, live load, hydrostatic load and wind load.** Compare the design outputs of software applications with those of manual calculations.
10.	Using a software application, **analyse and design of Foot truss bridge.** Compare the design outputs of software applications with those of manual calculations.
Reference Books:	
1	IS 800:2007, "Indian Standard, Code of Practice for General Construction in Steel", Bureau of Indian Standards, Bureau of Indian Standards (BIS), New Delhi, India.
2	IS 875 (Part-I), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-I, Dead loads, Bureau of Indian Standards (BIS), New Delhi, India.
3	IS 875 (Part-II), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-II, Imposed loads, Bureau of Indian Standards (BIS), New Delhi, India.
4	IS 875 (Part-III), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-III, Wind load, Bureau of Indian Standards (BIS), New Delhi, India.
5	IS 6533 (Part-I), "Indian Standard, Design, and construction of steel Chimney code of practice", Part-I Mechanical aspect, Bureau of Indian Standards (BIS), New Delhi, India.
6	IS 6533 (Part-II), "Indian Standard, Design, and construction of steel Chimney code of practice", Part-II Structural aspect, Bureau of Indian Standards (BIS), New Delhi, India.
7	SP 6 (I), "Handbook for Structural Engineers", Bureau of Indian Standards, New Delhi, India.
8	SP 38, "Handbook of Typified Design for Structures with steel roof trusses (with and without cranes)", Bureau of Indian Standards (BIS), New Delhi, India.
9	SP 40, "Handbook on Structures with Steel Portal Frames (without cranes)", Bureau of Indian Standards (BIS), New Delhi, India.
10	SP 64, "Explanatory Handbook on Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures", Part-III Wind Loads, Bureau of Indian Standards (BIS), New Delhi, India.

II Semester

23STR211– PE I : New Engineering Materials

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Classify engineering materials based on its structure.
2. Distinguish between elastic and plastic behavior of materials.
3. Distinguish between fibre reinforced Concrete and fibre reinforced Plastic
4. Relate materials like light weight concrete and advanced steel materials.

Unit:1	**Fiber reinforced Concrete**	**7 Hours**
Steel fiber reinforced concrete, Properties, Aspect ratio, strength and durability. **(Contemporary Issues related to Topic)**		
Unit:2	**Fiber reinforced Plastic**	**6 Hours**
Fiber reinforced plastics, other types of fibers and their applications.. **(Contemporary Issues related to Topic)**		
Unit:3	**Light weight concrete**	**6 Hours**
light weight concrete, foam concrete, fly ash concrete, workability, durability, and application.. **(Contemporary Issues related to Topic)**		
Unit:4	**High grade Concrete**	**7 Hours**
High-grade concrete, high strength performance concrete, trimix concrete **(Contemporary Issues related to Topic)**		
Unit:5	**Advance materials**	**7 Hours**
New engineering materials like light weight steel profile, aluminum profile, pressed steel sections **(Contemporary Issues related to Topic)**		
Unit :6	**Steel Concrete**	**6 Hours**
Introduction to steel concrete composite including infill, encased section, properties of shear connectors, use of IS: 11384, IRC 22. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Neville A. M., Properties of Concrete, Pearson Education Limited.
2	Rafat Siddequi , Special Concretes, Galgotia Publications.
3	M Gambhir, Concrete Technology, Tata Mcgraw Hill Education Private Limited.

Reference Books	
1	Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
2	Shetty M. S, Concrete Technology, S. Chand Publisher.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-0-412-37760-0

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105106053

II Semester

23STR212– PE I : Theory of Plates & Shells

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Demonstrate behavior of various plates 2. Analyze plates using different methods 3. Explain various theories of shells 4. Evaluate structural actions of shells using various theories

Unit:1	Governing differential equations for various plates	**7 Hours**
Development of governing differential equations by Kirchoff's theory with reference to thin rectangular plates with various boundary conditions. Symmetrical bending of laterally loaded circular plates with different boundary conditions **(Contemporary Issues related to Topic)**		
Unit:2	. Navier's solution	**6 Hours**
Study of Simply supported plates under different loadings. Navier's solution. Introduction to Levis solution. **(Contemporary Issues related to Topic)**		
Unit:3	**Finite difference method**	**7 Hours**
Application of finite difference method to plate problem **(Contemporary Issues related to Topic)**		
Unit:4	**Membrane theory of cylindrical shells**	**6 Hours**
Classification of Shells. Membrane theory of cylindrical shells with different directrix such as circular, cycloidal, catenary, and parabolic. **(Contemporary Issues related to Topic)**		
Unit:5	**Bending theory of cylindrical shells**	**7 Hours**
Bending theory of cylindrical shells, Finster walder, Schorer's, and D-K-J theory. **(Contemporary Issues related to Topic)**		
Unit :6	**Cylindrical shells by beam method**	**6 Hours**
Approximate analysis of cylindrical shells by beam method One issue is the need to simulate damage and failure, with the final goal to estimate lifetime of a structure. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Timoshenko S.P and Krieger S.W, Theory of Plates and Shells, 2nd Edition, McGraw-Hill Book Company, New Delhi, 1970.
2	Chadrashekhara K, Theory of Plates, 1st Edition, Universities Press (India) Ltd, Hyderabad, 2001.
3.	Ramaswamy, G.S, Design of Concrete Shells, Krieger Publ. Co., 1984

Reference Books	
1	Ramachandran S., Thin Shells (Theory and Problems) 1st Edition, Universities Press (India) Ltd, Hyderabad
2	Szilard R., Theory and Analysis of Plates, Prentice Hall Publication, 1974.
3	Philipee G Ciarlet, Mathematical elasticity Vol.II: Theory of plates, 1st Edition, Elsevier Science B V, 1997

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-540-76342-0
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/

MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/105/103/105103209/

II Semester

23STR213– PE I : Smart Structures & Applications

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Understand characteristics and behavior of smart materials. 2. Apply the Knowledge of actuators and sensors in mitigation techniques. 3. Explain the overall structural health monitoring related to earthquake behavior 4. Demonstrate the various types of Vibration Control Techniques..

Unit:1	**Smart Materials**	**7 Hours**
Introduction to smart structures, application, smart systems –Components of smart systems, different types smart materials – characteristics and behavior of smart materials – modeling of smart materials. **(Contemporary Issues related to Topic)**		
Unit:2	**Actuators and Sensors**	**7 Hours**
Introduction of sensors and actuators., features and - characteristics of sensors-types of sensors and actuators-electronic, thermal and hydraulic type actuators, characteristics of sensors and actuators. **(Contemporary Issues related to Topic)**		
Unit:3	**Structural Health Monitoring.**	**6 Hours**
Overview of structural health monitoring, Types of structural health monitoring,smart SHM application to new and existing buildings,Advantages and limitations, **(Contemporary Issues related to Topic)**		
Unit:4	**Base Isolation**	**7Hours**
Theory of Base Isolation ,Principle of base isolation, Methods, Techniques **(Contemporary Issues related to Topic)**		
Unit:5	**Vibration Controlled Techniques.**	**7 Hours**
Energy dissipation devices; introduction, Methods, principals **(Contemporary Issues related to Topic)**		
Unit :6	**Energy Deissipation devices**	**7 Hours**
Dampers,purpose,Types of energy dissipation devices; Metallic yield dampers, friction dampers, viscoelastic dampers, tuned mass dampers. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Srinivasan, A.V. and Michael McFarland, D., Smart Structures: Analysis and Design, Cambridge University Press, 2000.
2.	Yoseph Bar Cohen, Smart Structures and Materials 2003, The International Society for Optical Engineering 2003.

Reference Books	
1	Brian Culshaw, Smart Structures and Materials , Artech House, Boston, 1996.
2	M.V. Gandhi and B.S. thompson, Smart Materials and Structures , Chapman and Hall 1992
3	Damodarasamy and Kavitha," Basics of structural Dyanamics and Aseismic design, Phi Publisher, New Delhi.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/112104173

II Semester
23STR231– PE II : RC Tall Buildings

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Apply the fundamental concept and analyse Earthquake and wind load as per Indian standards. 2. Analyze and design shear wall for earthquake forces as per Indian standards. 3. Apply technical design principles and techniques such as p-delta effect, soil- structure interaction, etc. for a design of high-rise building. 4. Implement various codal provisions for ductility design of RCC Structures

Unit:1	**Earthquake and Wind Load Analysis on Structures as per Indian Standards**	**7 Hours**
Structural Systems and concepts. Loading: Gravity, wind and earthquake loading. Earthquake load and wind load Analysis of multi -storied buildings as per Indian Standards. **(Contemporary Issues related to Topic)**		

Unit:2	**Analysis and Design of Shear wall**	**6 Hours**
Introduction to Frame – shear wall buildings, Mathematical modeling of buildings with different Structural systems. Analysis & Design of shear walled buildings with ductile detailing as per IS 13920-2016. **(Contemporary Issues related to Topic)**		

Unit:3	**Special aspects in multi-storey buildings**	**6 Hours**
Special aspects in multi-Story buildings like effect of torsion, flexible first storey, P- delta effect, Soil – Structure Interaction on building response, drift limitations. **(Contemporary Issues related to Topic)**		

Unit:4	**Ductility considerations in earthquake resistant design of RCC buildings**	**7 Hours**
Ductility of reinforced members subjected to flexure. Design of braced columns using Indian Standards. **(Contemporary Issues related to Topic)**		

Unit :5	**Analysis of multi-storeyed buildings with bracings & infills**	**7 Hours**
Analysis and Design of multi-storeyed buildings with bracings & masonry in fills, Design of Beam - Column joints for ductile behaviours as per IS code provisions. **(Contemporary Issues related to Topic)**		

Unit :6	**Seismic Design of Diaphragm.**	**6 Hours**
Seismic Design Philosophy, Introduction to Diaphragm. Seismic Design of Floor Diaphragm. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1.	Agrawal &Shrikhande, Design of Earthquake Resistant Structures, 3 rd 2006, Prentice – Hall of India Pvt. Ltd
2.	Paulay, T. & Prestiley M.J.N., Seismic design of R C & Masonry Buildings, 2nd 1999, John Willey & Sons
3.	Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley
4.	S.K.Duggal, "Earthquake Resistant Design of Structures." 2004

Reference Books	
1	C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2	Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition.
3	Roberto Villaverde, Fundamental Concepts of Earthquake Engineering, 2009, CRC Press
4.	FarzadNaeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
5.	Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

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1	http://link.springer.com/openurl?genre=book&isbn=978-3-540-93817-0
2	https://drive.google.com/file/d/1WeI4wzsbzGqd-UGra1CWukcROIujg7jQ/view?usp=drive_web&authuser=2
3	https://drive.google.com/file/d/1sI5ppMZJX0OTN1cGHKjPBz8IANkzSAbR/view?usp=drive_web&authuser=2

MOOCs Links and additional reading, learning, video material	
1.	https://www.nicee.org/EQTips.php
2.	https://archive.nptel.ac.in/courses/105/104/105104200/
3.	https://archive.nptel.ac.in/courses/105/101/105101004/

II Semester

23STR232– PE II : Composite Structures

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Relate the basic concepts and characteristics of Composite materials. 2. Examine elastic behavior of lamina. 3. Interpret various failure theories. 4. Analyse laminated plates under bending and vibration

Unit:1	**Composite materials**	**7 Hours**
Introduction: definition, Classification and characteristics of Composite materials, advantages and limitations. Current Status and Future Prospects; Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotropy, Orthotropy and Anisotropy; **(Contemporary Issues related to Topic)**		
Unit:2	**Elastic Behaviour of Laminates.**	**6 Hours**
Characteristics and configurations of lamina, laminate, micromechanics and macro-mechanics. Constituent materials and properties; Elastic behavior of unidirectional lamina: Anisotropic, separately orthotropic and transversely isotropic materials, **(Contemporary Issues related to Topic)**		
Unit:3	**stress-strain behavior of laminates**	**6 Hours**
Stress-strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, Strength of unidirectional lamina. **(Contemporary Issues related to Topic)**		
Unit:4	**Failure theories of laminates**	**7 Hours**
Macro-mechanical failure theories- Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu) **(Contemporary Issues related to Topic)**		
Unit :5	**Elastic Behavior of multidirectional laminates**	**7 Hours**
Elastic Behavior of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties. **(Contemporary Issues related to Topic)**		
Unit :6	**Bending and vibration of laminated plates**	**6 Hours**
Bending and vibration of laminated plates: Governing equations, Deflection of simply supported rectangular symmetric angle-ply, especially orthotropic, anti-symmetric cross-ply laminates. Recent advances: Functionally graded materials, Smart materials **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1.	R.M. Jones, Mechanics of Composite materials, Taylor and Francis, 1999.
2.	M. Daniel and O. Ishai, Engineering mechanics of Composite materials, Oxford university press, 1999

Reference Books	
1	P.K. Mallick, Fiber-reinforced Composites, Marcel Dekker Inc, 1988.
2	D. Hull and T.W. Clyne, An introduction to composite materials, Cambridge university press, Second Edition, 1996.
3	J.N. Reddy, Mechanics of laminated composite plates and shells-Theory and Analysis, CRC Press, BocaRaton, Second Edition, 2003.

YCCE e - library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/101104010

II Semester

23STR233 – PE II : RC Bridge Design

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Identify the types of bridge to be used for various site and loading conditions. 2. Understand applicability of IRC codes related to bridges. 3. Analyze and design slab bridges and its components.

Unit:1	**Types of RC Bridges**	**7 Hours**
Types of RC bridge superstructure and introduction to their design, choice of type of bridges. Hydraulic Design: Importance of Hydraulic Factors in Bridge Design. **(Contemporary Issues related to Topic)**		
Unit:2	**Design Loads**	**6 Hours**
IRC Loads, Analysis of IRC Loads, Impact factors, Other loads to be considered in Bridge Design. **(Contemporary Issues related to Topic)**		
Unit:3	**Design of Slab bridge**	**7 Hours**
Reinforced concrete slab bridge, Effective width method, Dispersion length. Thrust Bed, Box Casting and Pushing techniques. **(Contemporary Issues related to Topic)**		
Unit:4	**Guidelines for Seismic Design of RC Bridges**	**6 Hours**
Seismic design philosophy for Bridges, Capacity design concept. Behavior Retaining wall. **(Contemporary Issues related to Topic)**		
Unit:5	**Analysis of Substructure**	**7 Hours**
Abutments, Stability Analysis of Abutments, Piers, Analysis of Piers. **(Contemporary Issues related to Topic)**		
Unit :6	**Bridge Bearings**	**6 Hours**
Bearings, Forces on Bearings, Types of Bearings, Basis for Selection of Bearings. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Jagdeesh R. and Jairam M., ― Design of bridges‖, PHI Publication New Delhi, 2nd edition,
2	N. Krishna Raju, Design of bridges, Oxford & IBH publishing Co. Ltd., New Delhi.
3	D. Johnson Victor, Essentials of bridge engineering, Oxford & IBH publishing Co. Ltd., New Delhi.

Reference Books	
1	IRC: 5 -1970, Standard specifications and code of practice for road bridges, Sections I to V, Indian Roads Congress, New Delhi.
2	IRC 006, Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fourth Revision), 2014.
3	Chen, W.F. and Duan, L., Bridge Engineering Handbook, CRC Press, 1999
4	Hambly, E.C., Bridge deck behaviour, Chapman and Hall, London
5	O'Brien E.J. and Keogh D.L., Bridge deck analysis, E& FN Spon, New York
6	IRC: 5 -1970, Standard specifications and code of practice for road bridges, Sections I to V, Indian Roads Congress, New Delhi.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/61.%20Bridge+Engineering+Handbook-+Seismic+Design,+Second+Edition-%20By%20EasyEngineering.net.pdf
2	https://onlinelibrary.wiley.com/doi/10.1002/9781118927595.ch2
3	https://link.springer.com/chapter/10.1007/3-540-32391-0_74
4	https://link.springer.com/chapter/10.1007/978-3-642-27963-8_21

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105105165
2	https://archive.nptel.ac.in/courses/105/105/105105165/
3	https://nptel.ac.in/courses/105105216

II Semester

23STR241 – PE III : Plastic Analysis & Design of Steel Structures

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Understand behavior of steel structure elements and basic concepts of plastic analysis 2. Apply techniques for estimation of collapse loads on steel structures 3. Analyze the effects of axial and shear forces on plastic moment of resistance. 4. Implement philosophies of plastic design of steel structural elements

Unit:1	**Introduction to Plastic Analysis**	**7 Hours**
Plastic behavior, review curves of structural steel, plastic moments, shape factors, load factors, plastic hinge, types of collapse, collapse mechanism, collapse load factor, step by step method. **(Contemporary Issues related to Topic)**		
Unit:2	**Basic Theorems and Collapse Load Factor**	**7 Hours**
Upper and lower bound, uniqueness theorem, principle of virtual work, statical method, minimum and maximum theorems, Determination of collapse load factor for beams and portal frames. **(Contemporary Issues related to Topic)**		
Unit:3	**Methods of Plastic Design**	**6 Hours**
Methods of release of restrains, load interaction diagrams, method of inequalities. **(Contemporary Issues related to Topic)**		
Unit:4	**Plastic Moment Distribution Method**	**6 Hours**
Plastic Moment distribution applied to continuous beams & portal frames (Max. two bays single story). **(Contemporary Issues related to Topic)**		
Unit:	**QEWRUIOP345 Effect of Shear Force**	**7 Hours**
Effect of Axial force & Shear force on Plastic moment of resistance, Design of simply supported and continuous beams. **(Contemporary Issues related to Topic)**		
Unit :6	**Design of Portal Frame**	**6 Hours**
Design of portal frames up to single storey – two bays. Minimum weight design. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Steel Skeleton, J. F. Baker, Volume II, 1st edition Cambridge University Press 1956
2	B.G. Neal – Plastic Method of Structural Analysis,3rd edition, Chapman & Hall,1997

Reference Books	
1	"Limit state Design of Steel Structures", S K Duggal, 2nd edition McGraw Hill education, 2014
2	"Limit State Design of Steel Structures", Dr. M R Shiyekar, 2nd edition, PHI Publication,2013
3	A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nem chand & Bros., Roorke,1996
4	Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi,2011
5	L.S. Beedle – Plastic Design of Steel Frames, John Willey & Sons.1958
6	Structural design in steel by Salwar Alam Raz New Age International Publishers,2003
7	Steel Designers Manual –, 6th edition, ELBS,2003

General Reading Suggested:	
1	Codes: IS: 800 - 2007 Code of Practice for General Construction in Steel Hand books
2	SP: 6 (6) – 1972 Handbook for Structural Engineers: Application of plastic Theory in Design of Steel Structures
3	Handbook for Structural Engineers SP 6 (8) 1972 (Reaffirmed 1993) – Bureau of Indian Standards.
4	Teaching Resource for Structural Steel Design – INSDAG Kolkatta

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/

MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/114/105/114105031/

II Semester

23STR242 – PE III : Seismic Analysis & Design of Structures

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Apply basic concepts Earthquake resistant design in construction industry.
2. Illustrate the Damages caused to the structures due to past earthquake and remedial measures.
3. Analyze and design of building components for earthquake forces.
4. Implement codal provisions related to static as well as dynamic analysis of RC and Steel buildings.

Unit:1	**Earthquake Resistance Design Philosophy**	**7 Hours**
Basics of ERDS, Performance of RC buildings, behavior of RC buildings in past earthquakes, influence of unsymmetry, infill walls, foundations, soft story, confinement of concrete. **(Contemporary Issues related to Topic)**		
Unit:2	**Ductile Detailing of Beam-Column Joint**	**7 Hours**
Review of IS 1893:2016 Part I -Capacity Based Design concept - Design for Strong column & weak beam, Design of Beam-Column Joints. **(Contemporary Issues related to Topic)**		
Unit:3	**Ductile Detailing of RC-Beam**	**7 Hours**
Behavior and failures of RC beam and recommendation for it, Ductile Deatiling of RC Beam. **(Contemporary Issues related to Topic)**		
Unit:4	**Analysis & Design of shear wall**	**6 Hours**
Lateral load Resisting System, Types of Shear Wall, Analysis & Design of shear walled buildings with ductile detailing as per IS 13920-2016. **(Contemporary Issues related to Topic)**		
Unit:5	Basics of Steel Design.	**7 Hours**
Performance of steel structures in past earthquakes-Seismic behavior of steel structures - design philosophy for steel structures, Basics of Steel Design. **(Contemporary Issues related to Topic)**		
Unit:6	**ERDS of steel structures.**	**7 Hours**
Capacity design concept, Ductility of steel buildings- Stability considerations. **(Contemporary Issues related to Topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Agrawal P. & ,Shrikhande M., Earthquake Resistant Design of Structures, Prentice hall India, New Delhi, 4th Edition, 2007.
2	Mazzolani, F.M.; &Piluso Theory and Design of Seismic Resistant Steel Frames E&FN Spon

Reference Books	
1	Paulay, T. &Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
2	Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
3	Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/20.%20Matrix%20methods%20of%20structural%20analysis%20(%20PDFDrive%20)-ebook.pdf

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105107204

II Semester
23STR243 – PE III : Design of Industrial Structures

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Comprehend the industrial structure planning.
2. Analyze and design the large span of industrial structures.
3. Analyze and design bunkers, and silos
4. Analyze and design foundations for industrial structures

Unit I: Planning of industrial structures	**9 Hours**
Classification of industries and local regulations, Factors affecting planning, General Aspects, Civil Engineering Aspects, Light and Ventilation **(Contemporary Issues related to Topic)**	
Unit II: Large span structures in industries	**10 Hours**
Cable roofs, Types of cable roofs, Analysis of a cable subjected to concentrated loads and uniformly distributed load, Complexities in the analysis of a cable roof, Overview of deep beams, Virrendel Girder, Castellated Girders, **(Contemporary Issues related to Topic)**	
Unit III: Silos and Bunkers	**10 Hours**
Concept of Angle of Repose, Pressure distribution, Dynamic loads, Stability of bunkers, Foundations. **(Contemporary Issues related to Topic)**	
Unit IV: Foundations for Industrial Structures	**10 Hours**
Machine foundations, General requirements, Design criteria, General analysis, Design of a block foundation for vertical compressor, Vibration Isolation, Foundations for Chimney and Microwave Towers. **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

Text Books	
1.	Srinivasula P., "Handbook of Machine Foundation", Tata Mc. Graw Hill Publications, New Delhi, India.
2.	Ramchandra, "Design of Steel Structures", Standard Book House, New Delhi, India.

Reference Books:	
1.	Raghupati M., "Design of Steel Structures", Tata Mc. Graw Hill Publication, Delhi, India.
2.	Dayaratnam P., "Design of Steel Structures", Wheelr's Publishers, Allahabad, India.
3.	Anand Arya & Ajmani J. L., "Design of Steel Structures", Nemchand & Bros., Roorkee, U.P., India, India.
4.	Lambert F.W., "The Theory & Practical Design of Bunkers", British Constructional Steelwork Association Ltd., London, UK.
5.	IS 800:2007, "Indian Standard, Code of Practice for General Construction in Steel", Bureau of Indian Standards, Bureau of Indian Standards (BIS), New Delhi, India.
6.	IS 875 (Part-I), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-I, Dead loads, Bureau of Indian Standards (BIS), New Delhi, India.
7.	IS 875 (Part-II), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-II, Imposed loads, Bureau of Indian Standards (BIS), New Delhi, India.
8.	IS 875 (Part-III), "Indian Standard, Code of practice for design loads (other than earthquake) for buildings and structures", Part-III, Wind load, Bureau of Indian Standards (BIS), New Delhi, India.
9.	IS 6533 (Part-I), "Indian Standard, Design, and construction of steel Chimney code of practice", Part-I Mechanical aspect, Bureau of Indian Standards (BIS), New Delhi, India.
10.	IS 6533 (Part-II), "Indian Standard, Design, and construction of steel Chimney code of practice", Part-II Structural aspect, Bureau of Indian Standards (BIS), New Delhi, India.
11.	SP 6 (I), "Handbook for Structural Engineers", Bureau of Indian Standards, New Delhi, India.
12.	SP 38, "Handbook of Typified Design for Structures with steel roof trusses (with and without cranes)", Bureau of Indian Standards (BIS), New Delhi, India.
13.	SP 40, "Handbook on Structures with Steel Portal Frames (without cranes)", Bureau of Indian Standards (BIS), New Delhi, India.
14.	SP 64, "Explanatory Handbook on Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures", Part-III Wind Loads, Bureau of Indian Standards (BIS), New Delhi, India.

YCCE e- library book links [Accessible from college campus]	
1.	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-5864-0

MOOCs Links and additional reading, learning, video material	
1.	https://archive.nptel.ac.in/courses/105/105/105105162/
2.	https://youtu.be/Om6ICuhwBo0
3.	https://www.youtube.com/watch?v=Ch2vAzvXbKI

III Semester
23STR301 – Project Phase-I

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Explain the advances in structural engineering
2. Apply the modern tools and techniques.
3. Act independently and in a team for effective communication.
4. Establish the importance of lifelong learning

S.N.	Contents
1	Literature review on current topic related to the structural engineering.
2	Preparation and presentation of progress seminars on topic selected for dissertation.
3	Submission of project report including introduction, literature review, objective and scope of investigation and pilot studies carried out during the semester.

IV Semester
23STR401 – Project Phase-II

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Explain the advances in structural engineering. 2. Apply the modern tools and techniques. 3. Act independently and in a team for effective communication and life-long learning 4. Solve real world structural engineering problems

S.N.	Contents
1	The of detailed study of a work including collection and analysis of data, determining solution, design, scientific research on topic selected for dissertation.
2	Preparation and presentation of progress seminars on topic selected for dissertation.
3	Submission of project report on the entire studies carried out during the semester