CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

FOR

MASTER OF TECHNOLOGY

(STRUCTURAL ENGINEERING)

IN

CIVIL ENGINEERING

[w. e. f. 2019-20]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
Plot No.39, Rajiv Gandhi Education City, P.S. Rai, Sonepat
Haryana-131029

MASTER OF TECHNOLOGY (STRUCTURAL ENGINEERING)

VISION

To emerge as a nationally recognized centre of excellence in the science and application of Structural engineering, fuelled by a rigorous and dynamic academic programme nurturing research and development in cutting edge areas, with strong emphasis on Industry linkages by way of rendering state of an art consultancy services.

MISSION

To impart quality civil engineering education attuned to the needs of the Industry with emphasis on practical exposure aided by well equipped laboratories, which in turn feed a vigorous research and development programme in addition to creating capabilities for industrial consultancy.

OUTCOME

Program Educational Objectives (PEOs) for M.Tech. program in Structural Engineering (SE):

PEO•1: To expose the graduate students to advanced Structural Analysis, Structural Dynamics, allied theory in elasticity and plasticity, FEM etc.

PEO•2: To impart training to graduate students in behavior and design of Advanced RC structures, behavior and design of Advanced Steel structure, latest procedures in earthquake resistant design practices and earthquake resistant design philosophies.

PEO•3: To expose the graduate students to latest design codes, current national and international scenario on Structural Engineering and to motivate them in interdisciplinary involvement in problems related to Structural Engineering.

PEO•4: To orient the graduate students to high value research related to Structural Engineering so that they get impetus to pursue research and lifelong learning.

Program Outcomes (POs) for the M.Tech. program in Structural Engineering (SE):

List of Program Outcomes (POs) of P.G. program in Structural Engineering:

a. Graduates of the program will be able to demonstrate in-depth knowledge of Structural Engineering discipline and build capability to apply that knowledge to real problems.
b. Program graduates will gain knowledge and skill in integrating Structural engineering concepts across multiple disciplines.
c. Graduates will have the ability to employ technical knowledge and leadership skills to Structural Engineering research and consultancy problems.
d. Graduates of the Structural Engineering program will demonstrate the ability to carry out original and useful research in key areas of Structural Engineering.
e. Program graduates will be able to identify and analyze the impact of Structural Engineering in development project and find a suitable solution from number of alternatives.
f. Graduates of the program will develop skills to communicate technical values of Structural Engineering research with the public, learners, practitioners and other community members of concern.
g. Program graduates will develop confidence in Structural analysis and management with high ethical value towards social, environmental and economic issues.
h. Graduates will develop enthusiasm and confidence to pursue lifelong learning for professional advancement.
i. Program graduates will develop the spirit of working in team for common objectives.
j. Graduates of the program will develop interest to pursue higher studies and research.

SCHEME OF EXAMINATION FOR MASTER OF TECHNOLOGY (STRUCTURAL ENGINEERING) DEGREE COURSE

SEMESTER – I

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19ST2001	MATRIX COMPUTER METHOD OF STRUCTURAL ANALYSIS	P	3	2	0	5	4
19ST2003	DESIGN OF ADVANCED REINFORCED CONCRETE STRUCTURES	P	3	2	0	5	4
19ST2005	DESIGN OF BRIDGES	P	3	2	0	5	4
19STPExx	PROGRAM ELECTIVE – I	E	3	0	0	3	3
19STPExx	PROGRAM ELECTIVE – II	E	3	0	0	3	3
19ST2011	MATERIAL TESTING LABORATORY	SD	0	0	4	4	2
TOTAL			**15**	**6**	**4**	**25**	**20**

SCHEME OF EXAMINATION FOR MASTER OF TECHNOLOGY (STRUCTURAL ENGINEERING) DEGREE COURSE

SEMESTER – II

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19ST2002	ADVANCED STEEL STRUCTURES DESIGN	P	3	2	0	5	4
19ST2004	FINITE ELEMENT METHOD WITH COMPUTER APPLICATION	P	3	2	0	5	4
19ST2006	PRESTRESSED CONCRETE STRUCTURES	P	3	2	0	5	4
19STPExx	PROGRAM ELECTIVE – III	E	3	0	0	3	3
19STPExx	PROGRAM ELECTIVE – IV	E	3	0	0	3	3
19ST2012	STRUCURAL ANALYSIS AND DESIGN LAB	SD	0	0	4	4	2
TOTAL			**15**	**6**	**4**	**25**	**20**

SCHEME OF EXAMINATION FOR MASTER OF TECHNOLOGY (STRUCTURAL ENGINEERING) DEGREE COURSE

SEMESTER – III

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19ST2101	PREPARATORY WORK FOR DISSERTATION	SD	0	0	20	20	**10**
19ST2103	SEMINAR	SD	2	0	0	2	**2**
19ST2105	LABORATORY**	SD	0	0	2	2	**1**
TOTAL			**2**	**0**	**22**	**24**	**13**

** *LAB RELATED TO DISSERTATION WORK*

SEMESTER – IV

SUBJECT CODE	SUBJECT NAME	SUBJECT TYPE	TEACHING SCHEDULE				CREDITS
			L	T	P/D	TOTAL	
19ST2102	DISSERTATION	SD	0	0	32	32	**16**

SCHEME OF EXAMINATION FOR MASTER OF TECHNOLOGY (STRUCTURAL ENGINEERING) DEGREE COURSE

CREDIT DISTRIBUTION

SEMESTER	DENOTE	I	II	III	IV	TOTAL	%AGE
PROGRAM ELECTIVE	E	6	6	-	-	12	**17.40**
SKILL DEVELOPMENT	SD	2	2	13	16	33	**47.83**
PROFESSIONAL CORE	P	12	12	-	-	24	**34.77**
TOTAL		**20**	**20**	**13**	**16**	**69**	**100**

LIST OF PROGRAM ELECTIVES

S.NO.	SUBJECT CODE	SUBJECT NAME
1	19STPE01	ADVANCED NUMERICAL ANALYSIS
2	19STPE02	CONCRETE TECHNOLOGY AND SPECIAL CONCRETES
3	19STPE03	DESIGN OF REINFORCED CONCRETE FOUNDATIONS
4	19STPE04	FOUNDATION ENGINEERING
5	19STPE05	PROGRAMMING AND COMPUTER AIDED DESIGN OF STRUCTURES
6	19STPE06	RELIABILITY ANALYSIS AND DESIGN OF STRUCTURES
7	19STPE07	SEISMIC DESIGN OF STRUCTURES
8	19STPE08	SOIL STRUCTURE INTERACTION
9	19STPE09	STRUCTURAL DYNAMICS
10	19STPE10	THEORY OF PLATES
11	19STPE11	DISASTER MANAGEMENT

FIRST YEAR
ODD SEMESTER

19ST2001	MATRIX COMPUTER METHOD OF STRUCTURAL ANALYSIS	L	T	P	C
		3	2	0	4
Co-requisite	None				
Pre-requisite	Basics of structural analysis				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Study and Understand the basic concepts of matrices	Understand flexibility & stiffness matrix analysis of different kinds of structures.
2	Understand and solve stiffness matrices for 2D structural elements	Write computer programs for 2D structural elements.
3	Understand and solve stiffness matrices for 3D structural elements	Write computer programs for 3D structural elements.
4	Understand and solve matrices problem for non-linear structural elements	Do Non-linear analysis of structures

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (BASIC CONCEPTS)		**8**		
1	Static and Kinematic indeterminacy	2	C	1
2	Stiffness and flexibility	2	C	1
3	Stiffness and flexibility for prismatic members	2	C,I	1
4	Stiffness and flexibility for non-prismatic members	2	C,I	1
UNIT -2 (DIRECT STIFFNESS METHOD 2D ELEMENT)		**10**		
5	Development of stiffness matrices for Truss element	2	C,I	2
6	Development of stiffness matrices for beam element	2	C,I	2
7	Transformation of coordinates	1	C,I	2
8	Assembly of global matrices-stiffness matrix	2	C,I	2
9	Load matrix	1	C,I	2
10	Boundary conditions	1	C,I	2
11	Solution techniques	1	C,I	2
UNIT -3 (DIRECT STIFFNESS METHOD 3D ELEMENT)		**10**		
12	Stiffness matrices for Truss element	2	C,I	3
13	Stiffness matrices for Beam element	2	C,I	3
14	Stiffness matrices for Grid element	1	C,I	3
15	Transformation matrix for 3D truss elements	1	C,I	3
16	Transformation matrix for 3D Beam elements	1	C,I	3
17	Computer programming	1	C,I	3
18	Application to practical problems	1	C,I	3
UNIT -4 (NON-LINEAR STRUCTURAL ANALYSIS)		**12**		
19	Material Non-linearity	1	C,I	4
20	Introduction to plastic analysis, mechanism	1	C,I	4
21	Non-linear stiffness matrix analysis: Iterative methods, Incremental methods	2	C,I	4

22	Hysteresis loops, Assumptions, member stiffness matrix	2	C,I	4
23	Modification of structural stiffness matrix, Incremental displacement and load vector, step by step Incremental analysis methods	2	C,I	4
24	Geometric non-linearity, Geometric stiffness matrix-2D truss element	2	C,I	4
25	Non-linear solution algorithms: Iterative methods, Incremental methods, convergence criteria	2	C,I	4
TOTAL CONTACT HOURS		**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Jain, A.K., Advanced Structural Analysis with Computer Applications, Nem Chand & Bros, Roorkee
2	Martin, H.C., Introduction to Matrix Method of Structural Analysis, McGraw Hill Book Co
3	Wang, C.K., 'Matrix Method of Structural Analysis', International Text Book, Pasadena.
4	Majeed, K.I., Non Linear Structural Analysis, Butterworth Ltd. London.
	REFERENCE BOOKS AND OTHER MATERIALS
5	
6	
7	
8	

19ST2003	ADVANCED REINFORCED CONCRETE STRUCTURES	L	T	P	C
		3	2	0	4
Co-requisite	None				
Pre-requisite	Basics of R.C. Elements, Structural analysis.				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Study and solve YLT and design of slab and flat lab	Understand the background of structural concrete and behaviour of beams in flexure
2	Analyse and design beams	Understand the behavior of beams in shear and torsion.
3	Analyse and design deep beams and slender members	Design columns in uniaxial and biaxial compression and combined loading.
4	Analyse and design shear walls and joints	Design RC and PSC members as per Indian Standards and specifications.
5	Detailing of members and joints as per BIS	Detail reinforcement in RC and PSC members as per Codes of Practice.

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**8**		
1	**Yield Line Theory**: Assumptions, location of yield lines, methods of analysis, analysis of one way and two way slabs.	3	C,D,I	1
2	**Strip Method of Design of slabs:** Theory, application to simply supported slab, slab fixed along edges and skew slabs.	3	C,D,I	1
3	**Flat slabs:** Limitations of Direct Design Method, shear in flat slabs, equivalent frame method, openings in flat slabs.	2	C,D,I	1
	UNIT -2	**8**		
4	**Ribbed slabs:** Introduction, analysis for moments and shear, deflection, arrangement of reinforcement.	2	C,D,I	2
5	**Approximate Analysis of grid floors:** Analysis by Timoshenko's plate theory, stiffness method and equating joint deflections.	3	C,D,I	2
6	**Redistribution of Moments in Beams:** Conditions for moment redistribution, single span beams, multi -span beams and design of sections.	3	C,D,I	2
	UNIT -3	**7**		
7	**Deep Beams:** Minimum thickness, design by IS -456, design as per British and American practice, beam with holes	2	C,D,I	3
8	**Spandrel Beams:** Design principles; moment, shear and torsion in beams, design of section.	2	C,D,I	3
9	**Slender columns and walls:** Effective length, unbraced and braced	2	C,D,I	3

	columns, stability index, columns subjected to combined axial and biaxial bending, braced and unbraced walls, slenderness of walls,			
10	Design of walls for vertical and in –plane horizontal forces.	1	C,D,I	3
UNIT -4		**7**		
11	**Shear walls:** Classification of shear walls, classification according to behavior and	1	C,D,I	4
12	Design of rectangular and flanged shear walls.	2	C,D,I	4
13	**Cast-in-situ Beam-column Joints:** Forces acting on joints, strength requirement of columns, anchorage,	2	C,D,I	4
14	Confinement of core, shear strength of joint, corner joint and procedure for design.	2	C,D,I	4
UNIT -5		**10**		
15	**Computation of deflection and crack width:** Short term and long term deflection of beams and slabs, calculation of deflection as per IS 456,	3	C,D,I	5
16	Factors affecting crack width in beams, calculation of crack width as per. IS 456, shrinkage and thermal cracking.	2	C,D,I	5
17	**Inelastic Analysis of beams and Frames:** Inelastic behaviour of reinforced concrete, stress -strain characteristics of concrete and steel	3	C,D,I	5
18	Concept of plastic hinges, effect of shear on rotation capacity, inelastic analysis, allowable rotation.	2	C,D,I	5
TOTAL CONTACT HOURS		**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Jain, A.K. (1999), "Reinforced Concrete Limit Slate Design", Nem chand & Bros, Roorkee
2	Krishna Raju (1986), "Advanced Reinforced Concrete Design", C.B.S. Publication, New Delhi
	REFERENCE BOOKS AND OTHER MATERIALS
5	Ferguson P.M., Breen J.E. and Jigsa J.O. (1988), Reinforced Concrete fundamentals", John wily & sons, New York.
6	Varghese, P.C. (2001),"Advanced Reinforced Concrete Design", Prentice Hall of India, New Delhi.

19ST2005	DESIGN OF BRIDGES	L	T	P	C
		3	2	0	4
Co-requisite					
Pre-requisite	Basics of structural analysis, R.C. & Steel Structures				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand bridge and its components as per BIS requirements	Understand types of bridges and codal provisions for loading and design standards of bridges.
2	Design of RC Bridge and its members	Design of R.C., Steel and Pre-stressed concrete bridges.
3	Design of Bearing of Bridge	Design and select materials suitable for bearings.
4	Design of Bridge Piers	Analyze and design the bridge substructures.

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (BRIDGE - INRODUCTION)		**9**		
1	Introduction to different types of bridges	2	C	1
2	Temporary bridges, Military bridges	1	C	1
3	Permanent bridges, R.C.C. bridges, Steel bridges	2	C	1
4	Prestressed Concrete bridges, Movable Steel bridges	2	C	1
5	Design Loads for Bridges, Load Distribution in Multi-Beam Bridges.	2	C,D	1
UNIT -2 (DESIGN OF R C BRIDGES)		**9**		
9	Design of R.C Bridges: Slab Culvert, Box Culvert, Pipe Culvert, T-Beam Bridges	2	C,D,I	2
10	Introduction to Arch and Bow string girder bridge	1	C,D,I	2
11	Design of Prestressed Concrete Bridges: Pre-Tensioned & Post Tensioned concrete bridges	2	C,D,I	2
12	Analysis & Design Of Multilane Prestressed Concrete T-Beam Bridges, Steel bridges and its types	3	C,D,I	2
13	Economical span, Stresses and loads.	1	C,D,I	2
UNIT -3 (BRIDGE GIRDER)		**8**		
17	Plate girder bridges: Arrangements & floors,	2	C,D,I	2
18	Plate girder railway bridges,	2	C,D,I	2
19	Deck type Plate girder bridges.	2	C,D,I	2
20	Truss Bridges: Arrangement & its Types	1	C,D,I	2
21	Wind forces on Lattice girder bridge	1	C,D,I	2
22	Bracings, Railway-Through Type Truss Bridges.		C,D,I	2
UNIT -4 (BRIDGE BEARING)		**7**		
25	Different types of Bearings and their Functions	2	C,D,I	3
26	IRC Provisions for Bearings, Permissible stresses in bearings	2	C,D,I	3

27	Design of Rocker and Roller-cum-Rocker Bearings	3	C,D,I	3
UNIT -5 (PIERS)		**7**		
34	Piers: Types, Analysis and Design	2	C,D,I	4
35	Design of Abutments & Wing Walls.	2	C,D,I	4
36	Bridge Foundations: Types and General design criteria, Design of pile and well foundations for piers and abutments.	3	C,D,I	4
TOTAL CONTACT HOURS		**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Rajgopalan, N., 'Bridge Super Structures', Narosa Publishing.
2	Krishna Raju, N., 'Design of Bridges', Oxford & IBH Pub. Co.
3	Krishna Raju, N., 'Prestressed Concrete', Tata McGraw Hill, New Delhi
	REFERENCE BOOKS AND OTHER MATERIALS
5	Mondorf, P.E., 'Concrete Bridges', Taylor & Francis
6	Victor, D.J., 'Essentials of Bridge Engineering', Oxford & IBH Pub. Co.

FIRST YEAR
EVEN SEMESTER

19ST2002	ADVANCED STEEL STRUCTURES	L	T	P	C
		3	2	0	4
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand and design roof members	General principle in the design of steel structures
2	Understand the design and forces on connections	Various types of connections
3	Design steel towers	Steel transmission line towers
4	Understand plastic analysis	Plastic method of structural analysis
5	Design Industrial structures	Analysis and design of industrial structures

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (GENERAL)		**9**		
1	Beams subjected to biaxial bending, Built up Purlins	2	C	1
2	Design of Wind girders, beam	2	C,D,I	1
3	Design of columns - With various support conditions	3	C,D,I	1
4	Design of foundations-with lateral forces	2	C,D,I	1
UNIT -2 (CONNECTIONS)		**9**		
5	Bearing type joints, unstiffened and stiffened seat connections	3	C	2
6	Moment resisting connection of brackets, bolted	3	C,D,I	2
7	Welded, semi, rigid connections	3	C,D,I	2
UNIT -3 (TOWERS)		**9**		
8	Basic structural configurations - free standing and guyed towers	3	C	3
9	loads on towers, wind loads	3	C,D,I	3
10	foundation design, design criteria for different configurations and transmission line towers	3	C,D,I	3
UNIT -4 (PLASTIC ANALYSIS)		**9**		
11	Theory of plastic bending, Plastic hinge concept	2	C	4
12	Mechanism method, Application to continuous beams and portal frames	3	C,D,I	4
13	Plastic moment distribution , Analysis of Gable frames	2	C,D,I	4
14	instantaneous centre of rotation - Connections	2	C,D,I	4
UNIT -5 (INDUSTRIAL BUILDINGS)		**9**		
15	Industrial buildings- braced and unbraced	3	C	5
16	Gable frames with gantry	2	C,D,I	5
17	Rigid industrial frames, Fire resistant design	3	C,D,I	5
18	Fatigue resistant design	1	C,D,I	5
TOTAL CONTACT HOURS		**45**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	N.Subramanian, "Design of Steel Structures: Theory and Practice", Oxford University Press, U.S.A, Third Edition, 2011
2	Duggal.S.K, "Design of Steel Structures", McGraw Hill New Delhi, 2010
3	Dayaratnam P. "Design of Steel Structures," S. Chand Limited, New Delhi. 2008
4	John E. Lothers, "Structural Design in Steel", Prentice Hall, 1999
	REFERENCE BOOKS AND OTHER MATERIALS
5	Neal. B.G., "Plastic Method of Structural Analysis", Taylor & Francis, Third Edition, 1985
6	Edwin.H.Gaylord, Charles.N.Gaylord, James. E. Stallmeyer, "Steel Structures", McGraw Hill, New Delhi, 1980.
7	Ramchandra, "Design of Steel Structures", Vol I & II Standard Book House, Delhi, 1975
8	Arya.S and Ajmani.J.L, "Design of Steel Structures", Nem Chand & Bros, Roorkee

19ST2004	FINITE ELEMENTS METHOD WITH COMPUTER APPLICATION	L	T	P	C
		3	2	0	4
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand FEM	Introduction to FEM and element properties
2	Study and analyze framed structures	Study and Understand analysis of framed structures
3	Analyze 3D stress analysis and plane and axisymmetric analysis	Study and Understand analysis of axisymmetric and 3D stress analysis
4	Analyze folded shells and plates	Study and Understand analysis of plane bending, folded shells and plates
5	Study and understand non-linear analysis	Study and Understand technique for non-linear analysis

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**10**		
1	**Introduction:** Brief history of the development, general description of the method	1	C	1
2	advantages and disadvantages of finite element method, displacement approach	1	C	1
3	**Basic Principles of Structural Mechanics:** Equilibrium Conditions, strain- displacement relations	1	C,I	1
4	linear constitutive relations, Principle of virtual work	1	C,I	1
5	energy principle, application to finite element method	1	C,I	1
6	**Element Properties:** Displacement models, relation between the modal degrees of freedom and generalized coordinates	2	C,I	1
7	convergance requirements, natural coordinate systems, shape functions (interpolation functions)	1	C,I	1
8	element strains and stresses, element stiffness matrix	1	C,I	1
9	equivalent nodal loads and static condensation	1	C,I	1
	UNIT -2	**8**		
10	**lsoparametric Elements:** Two and three dimensional isoparametric elements	2	C,I	2
11	evaluation of stiffness matrix using numerical integration techniques, convergence criteria	2	C,I	2
12	**Analysis of Framed Structures:** Two and three dimensional truss elements	1	C,I	2
13	two and three dimensional beam elements	1	C,I	2

14	shear deformation in beams and beams on elastic foundation	2	C,I	2
UNIT -3		**8**		
15	**Plane Stress, Plane Strain and Axisymmetric Stress Analysis**: Triangular elements, rectangular elements	1	C,I	3
16	isoparametric elements, Axisymmetric solid element	2	C,I	3
17	patch test	1	C,I	3
18	**Three Dimensional Stress Analysis:** Three dimensional solid elements	1	C,I	3
19	eight and twenty nodded isoperimetric solid elements	2	C,I	3
20	element load vector and evaluation of stresses	1	C,I	3
UNIT -4		**8**		
21	**Analysis of Plate Bending**: C and C2 displacement functions, plate bending elements	1	C,I	4
22	shear deformation in plates, four and eight nodded isoparametric plate elements	2	C,I	4
23	selective/reduced integration	1	C,I	4
24	behaviour of elements.	1	C,I	4
25	**Analysis of Folded Plates & Shells:** Review of shell elements, flat shell element	1	C,I	4
26	bilinear degarated shell element	1	C,I	4
27	eight noded shell element	1	C,I	4
UNIT -5		**8**		
28	**Solution of Finite Element Equilibrium Equations:** Direct solutions using alogrithms based on Gauss elimination	1	C,I	5
29	Direct solution using orthogonal matrices	1	C,I	5
30	Gauss-Siedel Iterative solution, frontal solution method and	1	C,I	5
31	solution of errors	1	C,I	5
32	**Techniques For Non Linear Analysis:** Non-linear problems nonlinear solution techniques	1	C,I	5
33	problems involving geometric non linearity	1	C,I	5
34	problems involving both material and geometric nonlinearity	1	C,I	5
35	convergence criteria	1	C,I	5
TOTAL CONTACT HOURS		**42**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	O.C. Zienkicwiez,'The finite Element Method, Third Ed., Tata-McGraw Hill Co.Delhi.(1988).
2	C. S. Krishnamoorthy 'Finite Element Analysis - Theory and Programming'. Tata McGraw Hill (1994).
3	
4	
	REFERENCE BOOKS AND OTHER MATERIALS
5	
6	
7	
8	

19ST2006	PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	2	0	4
Co-requisite	None				
Pre-requisite	Concrete Technology				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	To study the analysis of PSC flexural members	
2	To carry out the complete design of tension members	
3	To study analysis and design of compression member	
4	To study analysis and design of composite beam member	
5	To study analysis and design of indeterminate structures	

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (ANALYSIS OF PSC FLEXURAL MEMBERS)		**6**		
1	Basic Concepts, Stresses at transfer and service loads	2		
2	ultimate strength in flexure	2		
3	code provisions in - deflection (short - long term) in (IS, BS, ACI)	2		
UNIT -2 (DESIGN OF TENSION MEMBERS)		**8**		
4	Design for shear, bond and torsion Design of End blocks	2		
5	De sign of Tension Members	2		
6	Design of prestressed concrete cylindrical water tanks	2		
7	Design of prestressed concrete pipes	2		
UNIT-3 (DESIGN OF COMPRESSION MEMBERS)		**4**		
8	Compression members with and without flexure	2		
9	its application in design of piles.	2		
UNIT- 4 (COMPOSITE BEAMS)		**9**		
10	Composite construction with precast PSC beams and cast-in-situ R.C. Slab	2		
11	Analysis and Design - Ultimate Strength - their applications	2		
12	Special Structures like folded plates, prestressed cylindrical shells, spherical shells, partial prestressing	4		
13	Principles, analysis and design concepts of crackwidth.	1		
UNIT-5 (STATICALLY INDETERMINATE STRUCTURES)		**6**		
14	Analysis and design - continuous beams	2		
15	Concept of linear transformation	2		
16	concordant cable profile and cap cables	2		
TOTAL CONTACT HOURS		**33**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Prestressed concrete, N. Krishanraju, TMH Publications

2	Design of Prestressed Concrete Structures, 3rd Edition T. Y. Lin , A.P. Burns
3	Robert M Jones, "Mechanics of Composite Materials", 2ndEdition, Taylor and Francis/BSP Books, 1998.
4	R.N. Swamy, "New Concrete Materials", 1st Edition, Blackie, Academic and Professional, Chapman & Hall, 1983.

LIST OF PROGRAM ELECTIVES

19STPE01	ADVANCED NUMERICAL ANALYSIS	L	T	P	C
		3	0	0	3
Co-requisite					
Pre-requisite	Basics of Mathematics				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Introduction to programming	Will understand the concept of programming language C and its algorithm
2	Implement computational methods	Will be able to use programming language and civil engineering conceptual knowledge and imply the same to solve problems computationally
3	Conduct computational experiments	Use language to prepare software related to civil engineering structural analysis

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1		**8**		
1	**Introduction of Programming Language 'C':** Error analysis, significant digits, inherent errors, numerical errors	2	C	1
2	absolute and relative error, error propagation, conditioning & stability	2	C,	1
3	Solution of linear simultaneous equations, direct and iterative algorithms based on Gauss elimination	2	C,I	1
4	Gauss Jordan method, Gauss Seidel method	2	C,I,O	1,2
UNIT -2		**8**		
5	Numerical solution to non-linear system of equations, bisection method, false position method	2	C,I,O	1,2
6	Newton-Raphson method, Secant method, fixed point method	3	C,I,O	1,2
7	Interpolation formulae, Polynomial forms, linear interpolation, lagrange interpolation polynomial,	3	C,I,O	1,2
UNIT -3		**8**		
8	Newton interpolation polynomial, forward and backward differences	3	C,I,O	2,3
9	Numerical differentiation by forward difference quotient	2	C,I,O	2,3
10	Central difference quotient, Richardson extrapolation and numerical integration by Trapezoidal rule	3	C,I,O	2,3
UNIT -4		**8**		
11	Simpson's 1/3 rule, Romberg integration, Gaussian integration	3	C,I,O	2,3
12	Numerical solution of ordinary differential equations by Taylor series method	1	C,I,O	2,3

13	Euler's method, Runge-kutta method, Picard's method, Heun's method, polygon Method	4	C,I,O	2,3
TOTAL CONTACT HOURS		**32**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Terrence J.Akai , 'Numerical Methods', John Wiley & Sons lnc,Singapore,1994.
2	S.S.Shastry , 'Introductory Method of Numerical Analysis', PHI Pvt.Ltd.,1997
3	H.C.Saxena, 'Finite Differences and Numerical Analysis', S.Chand& Co.Delhi,2001.
4	Baron M.L. &Salvadori M.G., 'Numerical Methods in Engineering', PHI • Pvt.Ltd.1963
	REFERENCE BOOKS AND OTHER MATERIALS
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19STPE02	CONCRETE TECHNOLOGY & SPECIAL CONCRETES	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand concrete properties and mix design	To familiarize with the fundamentals of concrete and mix design
2	Understand different concreting methodologies	To study the different concreting methods
3	Understand difference between various special concrete	To understand the basic concepts of special concretes, types, properties and their applications
		To understand the basics of development in concrete material
		To study the application of different concretes

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (CHARACTERISTCS OF CONCRETE AND MIX DESIGN)		**8**		
1	Properties of fresh and hardened concrete - strength, elastic properties, creep and shrinkage	2	C	1
2	variability of concrete strength, quality control, Principles of concrete mix design, methods of concrete mix design	2	C,I	1
3	High Strength Concrete Mix Design, Super Plasticizers	2	D,I	1
4	Principles involved in mix design of high performance concrete with fly ash or GGBS replacements	2	D,I	1
UNIT -2 (CONCRETING METHODS)		**8**		
5	Process of manufacturing of concrete, methods of transportation	2	C	2
6	placing and curing, extreme weather concreting, special concreting methods	2	C,I	2
7	vacuum dewatering, under water technology	2	C,I	2
8	special form work, Ready mix Concrete	2	C,I	2
UNIT -3 (POLYMER AND FIBER CONCRETES)		**8**		
9	Polymer concrete-Types, Properties and Applications, Blended cement concretes	3	C,I	3
10	Fibre reinforced Concrete, Different types of metallic and non-metallic fibres	2	C,I	3
11	Types, Properties and Applications, Slurry- infiltrated fibre reinforced concrete	3	C,I	3

UNIT -4 (FERROCEMENT, LOW AND HIGH DENSITY CONCRETES)		**8**		
12	Ferrocement and its applications, Light Weight concrete,	2	C,I	3
13	High Density concrete- Types, Properties and Applications	3	C,I	3
14	Roller compacted concrete - Types, Properties and Applications.	3	C,I	3
UNIT -5 (OTHER CONCRETES)		**8**		
15	Bacterial concrete - Born again concrete (Recycled Aggregate concrete)	2	C,I	3
16	Electric concrete (Smart concrete) description – applications, High performance concrete- Production and applications	2	C,I	3
17	Self-compacting concrete	2	C,I	3
18	Reactive powder concrete- Description, Properties and Applications	2	C,I	3
TOTAL CONTACT HOURS		**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Fintel, "Hand book of Concrete Enssi Vannostrand", CBS Publishers & Distributors, 2004
2	Metha P.K. and Monterio P.J.M. "Concrete-Structures", Properties and Materials, 3rd Edition, McGraw Hill Professional, 2006.
3	M.S. Shetty, "Concrete Technology" S. Chand and Company Ltd, Delhi, 2000.
4	Neville.A.M. "Properties of Concrete", Pitman Publishing Limited, London, 1990
	REFERENCE BOOKS AND OTHER MATERIALS
5	Aitkens, "High Performance Concrete", McGraw Hill, 1999
6	Rudhani G., "Light Weight Concrete" Academic Kiado, publishing home of Hungarian Academy of Sciences, 1963.
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19STPE03	DESIGN OF REINFORCED CONCRETE FOUNDATIONS	L	T	P	C
		3	0	0	3
Co-requisite					
Pre-requisite					
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	To study Structural aspects of footings	Design isolated footings and analyse its various members
2	To study design of rafts and piles	Should be able to design raft foundation for important structures
3	To know design of piles	Should be able to design all kinds of concrete piles and pile cap
4	To study analysis of flexible beams on elastic foundations	Should be able to understand the loads on beams and analyse those loads for safe designing
5	To know the Structural design of steel towers-machine foundations	Should be able to design concrete foundations for towers

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (INTRODUCTION)		**8**		
1	Review of limit state design of reinforced concrete	2	C,I	1
2	Structural design of isolated footings	1	D,I	1
3	Structural design of column pedestals	1	D,I	1
4	Structural design of column footings	1	D,I	1
5	Structural design of combined foot strap footings	1	D,I	1
6	Structural design of strip footings under several columns	2	D,I	1
UNIT -2 (STRUCTURAL DESIGN OF RAFT FOUNDATION)		**8**		
7	Design flat slab rafts, mat foundations	2	D,I	2
8	Design beam and slab rafts, combined piled raft foundations(CPRF)	3	D,I	2
9	Design circular and annular rafts	3	D,I	2
UNIT -3 (STRUCTURAL DESIGN OF PILES)		**9**		
10	Structural design of different types of piles	1	D,I	3
11	Structural design of under reamed pile foundations	2	D,I	3
12	Design of pile cap-Pile foundation	2	D,I	3
13	Design of large diasocketed piles-in filled virendeel frame foundations	2	D,I	3
14	Design of steel column bases	2	D,I	3
UNIT -4 (ANALYSIS OF BEAMS)		**9**		
15	Analysis of flexible beams on elastic foundations	2	D,I	4
16	ACI method for analysis of beams and grids on elastic foundations	2	D,I	4

17	Analysis of flexible plates on elastic foundations	2	D,I	4
18	shells for foundations, Hyperbolic paraboloid (Hyper) shell foundations	2	D,I	4
19	Design of conical shell foundation	1	D,I	4
UNIT -5 (FOUNDATION FOR TOWERS)		**8**		
20	Design of foundation for towers, steel towers	2	D,I	5
21	machine foundations, general design principles	2	D,I	5
22	structural design of foundation to Rotary machine	2	D,I	5
23	structural design of foundation to reciprocating machine and impact machine	2	D,I	5
TOTAL CONTACT HOURS		**42**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	P.C. Varghese, "Design of Reinforced Concrete Foundations", Prentice-Hall of India Pvt Ltd, 2009.
2	P.C. Varghese, "Foundation Engineering" - Prentice-Hall of India Pvt Ltd.
3	Kurien.N.P, "Design of foundation systems-Principles and Practices",3rd Edition, Alpha Science International, 2005.
4	Bowles.J.E, "Foundation Analysis & Design", Fifth edition, McGraw Hill-New Delhi (1997)
	REFERENCE BOOKS AND OTHER MATERIALS
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19STPE04	FOUNDATION ENGINEERING	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	Basics and Applied soil mechanics				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand requirements for shallow foundation	Analyze the bearing capacity of foundations on cohesive & cohesion less soil.
2	Understand about pile foundation and its load transferring concept	Perform field experiment related to calculation of settlement in foundations.
3	Understand cassion and its construction	Design different kind of foundations, and cofferdams
4	Understand the problems faced for construction of foundation on poor soil or sub-soils	Perform sub-soil exploration and calculate
5	Understand design of coffer dam	

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (SHALLOW FOUNDATION)		**12**		
1	Introduction, factors deciding depth of foundation,	1	C	1
2	effect of water table on bearing capacity, points of difference between Rankine's, Terzaghi's, Meyerhof's, Skempton's bearing capacity theories	2	C	1
3	footings on slopes, footing with eccentric and inclined loads, bearing capacity of footings on layered soils	1	C,I	1
4	bearing capacity from SPT, SCPT, DCPT, bearing capacity of foundation with uplift forces	2	C,I	1
5	bearing capacity of rafts on sands and clays, distribution of contact pressure	1	C,I	1
6	plate load test and interpretation, settlement of footing, immediate and consolidation settlement	2	C,I	1
7	settlement from SPT and SCPT, settlement by Schmertann approach	2	C,I	1
8	computation of immediate settlement	1	C,I	1
UNIT -2 (PILE FOUNDATION)		**8**		
9	Uses of piles, static method of pile load capacity	1	C,I	2
10	negative skin friction, group action in piles	2	C,I	2
11	pile load test, cyclic pile load test	2	D,I	2
12	computation of settlement of pile group	1	D,I	2
13	piles subjected to lateral loads	1	C,I	2
14	dynamic formulae calculate the load on piles	1	D,I	2
UNIT -3 (CAISSON)		**8**		

15	Introduction, static method to find out load carrying in sands and clays	2	C,I	3
16	design of open caisson	1	D,I	3
17	types of caissons and their advantages and disadvantages	2	C,I	3
18	forces acting on well foundations	1	C,I	3
19	stability of well foundations	1	C,D,I	3
20	IS recommendations for tilts and shifts	1	C	3
UNIT -4 (FOUNDATIONS ON DIFFICULT SUB-SOILS)		**8**		
21	Collapsible soil, physical parameters for identification, procedure for calculating collapse settlement	1	C,I	4
22	foundation design for soils not susceptible and susceptible to wetting	1	D,I	4
23	expansive soils, identification, swell potential and swell pressure, methods of foundations on expansive soils	2	C,D,I	4
24	replacement of soil and CCN concept, construction on expansive soils, sanitary landfills	2	C,I	4
25	under-reamed piles-applications	1	C,D,I	4
26	static formulae to calculate to under- reamed pile capacity	1	C,D,I	4
UNIT -5 (COFFERDAMS)		**6**		
27	Various types, their application	2	C	5
28	design and lateral stability of braced cofferdam	2	C,D,I	5
29	design and stability of cellular cofferdams	2	C,D,I	5
TOTAL CONTACT HOURS		**42**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao
2	Soil Engineering in Theory and Practice by Alam Singh
3	
4	
	REFERENCE BOOKS AND OTHER MATERIALS
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19STPE05	PROGRAMMING AND COMPUTER AIDED DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3
Co-requisite					
Pre-requisite					
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Design structural elements/components, application to multistoried building	Student should be able to use computer software to analyse and design structural elements, water retaining structures, bridge components, multistoried building etc.
2	Design water retaining structures and bridges components.	
3	Analyze the static and dynamic analysis of structures	

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
1	C++ Programming basics	2	C,O	1
2	Loops and Decisions, Structures	2	C,O	1
3	Function, object and classes	2	C,O	1
4	Operator overloading	2	C,O	1
5	Inheritance	2	C,O	1
6	Pointers, files and streams, library	2	C,O	1
7	Graphics hardware, Interactive input and output devices	2	C,O	1
8	Extensive use of latest packages	2	C,O	1
9	Static and dynamic structural analysis and finite element packages	2	C,O	1
10	Development of design and drafting packages for structural elements/components	3	C,O	1
11	Application to multistoried building,	2	C,O	1
12	Design of water retaining structures and bridges components	2	C,O	2
13	Use of Auto CAD, STAAD Pro.	3	C,O	2,3
14	Grapher and Finite Element Packages	2	C,O	2,3
Total		**30**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Rajaram R., 'Object Oriented Programming and C++'.
2	Balagurusamy E. , 'Object Oriented Programming and C++'.
3	Lafore R.,' Turbo C++
	REFERENCE BOOKS AND OTHER MATERIALS
5	Software related manuals

19STPE06	RELIABILITY ANALYSIS & DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	Basics of Structural Analysis				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand load types and analysis	Solve problems related to contemporary issues in structural Engineering by acquiring knowledge of mathematics, science and engineering.
2	Understand and obtain structural reliability	To understand degree of freedom system.
3	Compute reliability index and solve simple problems	Do analysis of practical problems related to earthquake phenomenon.
4	Apply safety checks	Do Non-linear analysis of structures

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
	UNIT -1	**8**		
1	**Introduction**-Structural safety-,variations, Random variables	3	C,I	1
2	Probability distributions, Allowable stresses for specified reliability.	2	C,I	1
3	**Probabilistic analysis of loads** Gravity loads, Wind loads, Wind speeds, return periods, Multi Degree of Freedom Systems.	3	C,D,I	1
	UNIT -2	**8**		
4	**Structural Reliability** - Reliability of structural components ,beams, axially loaded columns	4	C,D,I	2
5	**Reliability Methods** - Classification (Level 1, level 2 & level 3), First order second moment method	4	C,D,I	2
	UNIT -3	**8**		
6	**Reliability index**-Computation of reliability index, simple problems.	2	C,I	2,3
7	**Reliability based design** - Determination of partial safety factors, Safety checking formats,	3	C,D,I	3
8	NBC format, CEB format, LRFD format, Optimal safety factors.	3	C,I	3,4
	UNIT -4	**8**		
9	**Reliability of Structural systems** - System reliability, Series system	4	C,I	4
10	Parallel redundant system, mixed system, Modeling of truss system, Modeling of frames	4	C,I	4
	TOTAL CONTACT HOURS	**32**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	H.O. Madsen, S. Krenk, and N.C. Lind, "Methods of Structural Safety", Dover Publications, 2006.
2	R. Ranganathan, "Structural Reliability Analysis and Design", 1st Edition, Jaico Publishing House, 1999.
3	R.E. Melchers, "Structural Reliability Analysis and Prediction", 2nd Edition, John Wiley & Sons, 1999.
4	Thoft C.P, and Baker M.J, "Structural Reliability Theory and Its Applications", Springer Verlag, 1982.
	REFERENCE BOOKS AND OTHER MATERIALS
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19STPE07	SEISMIC DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand about earthquake and its causes	To develop systematic knowledge of earthquake and its causes
2	Understand the behavior of structural elements under EQ	To understand the basic concepts related to structural design for earthquake loads
3	Carry out analysis and planning of structural members	To develop an idea about various structural systems adopted
4	Understand about ductile detailing of members as per BIS	To familiarize with design and detailing of various types of systems
5	Understand about retrofitting and rehabilitation of structures and various methods	To introduce fundamentals of repair and rehabilitation techniques

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (INTRODUCTION)		**8**		
1	Introduction to engineering seismology, various theories, measurement scales	3	C	1
2	vibration measuring instruments, Past earthquakes in India and world	2	C,I	1
3	Response spectrum, significance, construction & use	3	C,I	1
UNIT -2 (STRUCTURAL MATERIALS AND SYSTEMS)		**8**		
4	Performance of structural materials under cyclic loads- masonry, steel, concrete, soil	2	C,I	2
5	Various structural systems in steel and concrete for horizontal load transfer	2	C,D,I	2
6	their behavior and limitations, braced frames	2	C,D,I	2
7	rigid frames, shear walls, wall-frame systems	2	C,D,I	2
UNIT -3 (STRUCTURAL PLANNING AND ANALYSIS)		**10**		
8	Seismic design philosophy, Design spectrum, ductility based analysis	2	C,D,I	3
9	capacity design concepts, pushover analysis concepts	2	D,I	3
10	energy based design Layout and planning of buildings in seismic zones	2	C,I	3
11	regular and irregular buildings, centre of rigidity and centre of mass,	2	C,I	3

	torsion			
12	Computing storey shear, drift - using provisions of Bureau of Indian Standards (BIS) codes	2	C	3
UNIT -4 (DESIGN AND DUCTILE DETAILING)		**8**		
13	Load combinations, Ductility based design	2	C,D,I	4
14	Detailing for seismic performance	2	C,D,I	4
15	Provisions of IS: 13920 for RCC structural elements, frames, shear walls	2	C	4
16	Design of shear walls	2	D,I	4
UNIT -5 (SEISMIC RETROFITTING AND ISOLATION)		**8**		
17	Damage Assessment techniques - safety analysis and rating	2	C,I,O	5
18	Reliability assessment - Retrofitting techniques - materials	3	C,I,O	5
19	Base Isolation techniques - Active and passive control devices	3	C,I,O	5
TOTAL CONTACT HOURS		**42**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Paulay, T. and Priestly, M.N.J., "Aseismic Design of Reinforced Concrete and Masonry Building", John Wiley and Sons, 1987
2	Agarwal, P., and Shrikhande, M., “Earthquake Resist ant Design of Structures” Prentice Hall of India, New Delhi, 2007
3	Anil.K.Chopra, “Dynamics of Structures (Theory and Applications to Earthquake Engineering)” , 3rd Edition, Prentice Hall of India Private Limited. New Delhi, 2009
4	Short course on Seismic Design of Reinforced Concrete Buildings, CEP, IIT, Kanpur, Dec.1995
	REFERENCE BOOKS AND OTHER MATERIALS
5	Course Notes, "Structural Design for Dynamic Loads", SRM Engineering College, 2002
6	Allen.R.T., and Edwards.S.C, "Repair of Concrete Structures” , second edition Blackie Academic & Professional, an imprint of Chapman hall, U.K. 1993
7	Lecture Notes, "Health Monitoring of Structures - A Proactive Strategy", ISTE Sponsored course held at SRMEC, Jan 2003
8	Guidelines for - "Improving Earthquake Resistance of Housing", Building Materials and Technology Promotion Council, Ministry Of Urban Development and Poverty Alleviation, Department of Urban Employment and Poverty Alleviation, Government of India, New Delhi, 1999 – 2000.

19STPE08	SOIL STRUCTURE INTERACTION	L	T	P	C
		3	0	0	3
Co-requisite					
Pre-requisite	Basics of soil-mechanics and structural analysis.				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Carry out analysis of soil-foundation-structure interaction	Understand soil-structure-interaction models.
2	Study and understand elastic modelling	Analyze linear and non-linear soil-structure-interaction problems on different kinds of foundations.
3	Study and analyze soil-structure interaction of members	Analyze the soil-structure interaction of framed structures.
4	Study and analyze soil-structure interaction of important structutes	Analyze of soil-foundation-structure interaction and various related models.

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1		**6**		
1	Soil-foundation-structure interaction	1	C	1
2	Soil-fluid-structure interaction	1	C	1
3	Idealization of soil by linear, Idealization of non-linear, modified Winkler model	1	C,I	1
4	Elastic continuum model (isotropic and anisotropic)	1	C,I	1
5	Two parameter elastic models- Heteny model	1	C,I	1
6	Pasternak model, Reissner model	1	C,I	1
UNIT -2		**6**		
7	Soil parameters: Interpretation of parameters encountered in various idealized soil models-Winkler,	2	C,I	2
8	Two parameter elastic and Elastic continuum models	1	C,I	2
9	Finite beams on elastic foundations: finite beams on Winkler models	1	C,I	2
10	Finite beams on two parameter elastic model and Elastic continuum	1	C,I	2
11	Finite difference solution to problems of beam on linear and non-linear, Winkler's model	1	C,I	2
UNIT -3		**6**		
12	Plates on elastic foundation: Rectangular and continuous plates on elastic foundations	2	C,I	2,3
13	Plates carrying rows of equidistant columns, rectangular and circular plates on Winkler medium	1	C,I	2,3
14	Two parameter elastic medium and no elastic continuum	1	C	3

15	Finite difference solution of problems of rectangular plates on linear and non-linear elastic foundation.	2	C,I	3
UNIT -4		**6**		
16	Soil structure interaction in framed structures: structures with isolated foundation, spring analog approach	2	C	3,4
17	Determinations of spring parameters, structures with continuous beams and rafts as foundation, finite element modelling, sub-structure technique of analysis	2	C,I	3,4
18	Concept of relative stiffness, Interactive behavior of some framed structure	2	C,I	3,4
UNIT -5		**6**		
19	Soil pile interaction: laterally loaded single piles-Concept of coefficient of horizontal subgrade reaction	1	C	4
20	Finite difference and finite element solution, soil-structure interaction of framed structures with pile foundation	1	C,I	4
21	Interaction of other structures with soil foundation system, Tanks with annular ring foundations	1	C,I	4
22	Chimneys, silos, cooling towers, underground subways and tunnels	1	C	4
23	Introduction to dynamic soil structure interaction as well as non-linear soil/concrete behavior	2	C	4
TOTAL CONTACT HOURS		**30**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	John, P. Wolf, 'Dynamic Soil-Structure-Interaction'.
2	John, P. Wolf, Soil-Structure-Interaction in Time Domain'.
3	Desai, C.S., Srivardhane, Constitutive Modelling of Soils and Rocks.

19STPE09	STRUCTURAL DYNAMICS	L	T	P	C
		3	0	0	3
Co-requisite					
Pre-requisite					
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand about structural dynamics	Solve problems related to contemporary issues in structural Engineering by acquiring knowledge of mathematics, science and engineering.
2	Understand and solve problems for SDOF system	To understand degree of freedom system.
3	Understand and solve problems for MDOF system	Do analysis of practical problems related to earthquake phenomenon.
4	Conduct abd Analyze non-linear structural elements	Do Non-linear analysis of structures

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1		**6**		
1	Introduction: Objectives, difference between static and dynamic analysis	2	C	1
2	Loading, essential characteristics of a dynamic problem	2	C	1
3	Principles of dynamics	1	C,I	1
4	Formulation of equation of motion	1	C,I	1
UNIT -2		**10**		
5	Single Degree of Freedom System: Analysis for free and forced vibration, Duhamels integral,	2	C	2
6	Damping - types and evaluation	1	C,I	2
7	Response of SDOF systems to harmonic excitation	1	C,I	2
8	Periodic excitation, Impulsive loading, arbitrary, step, pulse excitation,	2	C,I	2
9	Response to general dynamic loading.	1	C,I	2
10	Numerical evaluation of dynamic response- superposition and step by step methods	2	C,I	2
11	Generalized SDOF systems	1	C,I	2
UNIT -3		**12**		
12	Multi Degree of Freedom Systems: Equations of motion, evaluation of structural property matrices	1	C,I	3
13	Problem statement and solution methods, free vibration	1	C,I	3

14	Forced harmonic vibration, damped motion for MDOF, generalized co-ordinates	1	C.I	3
15	Principle of orthogonality of modes, Eigenvalue problem, modal response	2	C,I	3
16	Approximate methods: Stodalla-Vinaello, Modified	1	C,I	3
17	Rayleigh's method	1	C,I	3
18	Holzer's method, Holzer Myklested method	1	C,I	3
19	Matrix method, Energy method	1	C,I	3
20	Lagrange's equation, Modal analysis	1	C,I	3
21	Stochastic response of linear SDOF and MDOF system to Gaussian inputs	2	C,I	3
UNIT -4		**12**		
22	Continua with Infinite Degrees of Freedom: Longitudinal vibrations of prismatic	2	C,I	4
23	Torsional vibrations of circular shafts	1	C,I	4
24	Transverse vibrations of stretched wires, transverse vibrations of prismatic beams,	2	C,I	4
25	Effect of rotary inertia and shearing deformations	1	C,I	4
26	Beams subjected to support motions	2	C,D	4
27	Beams traversed by moving loads, coupled flexural	2	C,D	4
28	Torsional vibrations of beams	1	C,I	4
29	Transverse vibrations of plates	1	C,I	4
TOTAL CONTACT HOURS		**40**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Grover, G.K, 'Mechanical Vibration', Nem Chand and Bros. Roorkee
2	Cough and Penzien, 'Dynamics of Structures' McGraw Hill Book Co.
3	Chopra, A.K., 'Dynamic of Structures- theory and Application to Earthquake Engineering'.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Weaver, Timoshenko & Young, "Vibration problems in Engg." John Wiley & Sons. 1990

19STPE10	THEORY OF PLATES	L	T	P	C
		3	0	0	3
Co-requisite					
Pre-requisite	Mechanics of Solids and Theory of Elasticity				
Data Books / Codes / Standards					
Course Category	P PROFESSIONAL CORE				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Understand behaviour of plates for UDL, hydrostatic, concentrated load cases.	Student will be able to understand concepts of deflection, bending of various geometrical shapes and solve the problems related to them.
2	Perform cylindrical bending of long rectangular plates, pure bending of rectangular and circular plates, and small deflection theories for various boundary conditions.	Students will be able to solve problem related to rectangular plates
3	Understand membrane theory and structural behavior of plates.	Students will be able to understand and solve problem related to plates and elastic buckling of plates
4	Implement Whitney's method to analyze folded plates.	Students will be able to solve problems related to composite plates

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1		**10**		
1	Theory of thin plates with small deflection, bending of long rectangular plates to a cylindrical surface	1	C	1
2	Pure Bending of Plates-Slopes and Curvatures of slightly bend plates, relations between moments and curvatures, particular cases of pure bending of plates	2	C	1
3	strain energy in pure bending, limitations of pure bending theory	1	C	1
4	Symmetrical bending of circular plates, Differential equation for symmetrical laterally loaded circular plates	1	C,I	1
5	uniformly loaded circular plates, circular plates with a circular hole at the centre	1	C,I	1
6	circular plate concentrically loaded and circular plate loaded at the centre	1	C,I	1
7	**Small deflections of Laterally Loaded Plates**: Differential equation of the deflection surface, boundary conditions	2	C,I	1
8	exact theory of plates	1	C,I	1
UNIT -2		**8**		
9	**Simply Supported Rectangular Plates**: Plates under sinusoidal loads, Navier's solution for tidl	2	C,I	2

10	patch load and concentrated load	2	C,I	2
11	Levy's solution for udl, plates under hydrostatic load	2	C,I	2
12	plates of infinite length	2	C,I	2
UNIT -3		**12**		
17	**Analysis of Plates Using Finite Difference Method:** Transforming differential equation of equilibrium into finite difference equation	2	C,I	2,3
18	Transforming various types of edge conditions into finite difference equations, solving rectangular plates subjected to various types of loads and various types of edge conditions	2	C,I	2,3
19	discretizing plates of various shapes into finite different mesh form and solving for various loading and edge conditions	2	C,I	2,3
20	**Bending of Anisotropic Plates:** Differential equation of the bent plate, determination of rigidities in various special cases	2	C,I	2,3
21	application of the theory to the calculation of grid works	2	C,I	3
22	bending of rectangular circular and elliptic plates	2	C,I	3
UNIT -4		**8**		
25	**Elastic Buckling of thin plates:** Differential equations of plate buckling, critical loads for rectangular plates	1	C,I	3,4
26	plates with all edges simply supported and under uniaxial compression	2	C,I	3,4
27	plates with two opposite edges simply supported under uniaxial compression	1	C,I	3,4
28	plates with all edges simply supported under biaxial compression	1	C,I	3,4
29	**Shear Deformation Theories:** First order shear deformation plate theory, higher order shear deformation plate theory	2	C,I	3,4
30	effect of shear deformation on bending of thin plates	1	C,I	4
UNIT -5		**6**		
33	**Bending Analysis of Laminated Composite Plates:** Strain displacement relations, governing differential equation of equilibrium	2	C,I	4
34	lamination configuration types, analysis of symmetric and anti - symmetric laminated plates	2	C,I	4
35	cylindrical bending of laminated plates	2	C,I	4
TOTAL CONTACT HOURS		**44**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Timoshenko, S.P.and Krieger, S.W., 'Theory of Plates and Shells' McGraw Hill 2" ED
2	Florin, G., 'Theory and Design of Surface Structures and Slabs/Plates
3	Szilard, R., 'Theory 8c Analysis of Plates'
4	Chandrashekhara, K., 'Theory of Plates' Universities Press, Hyderabad
	REFERENCE BOOKS AND OTHER MATERIALS
5	
6	
7	
8	

19STPE11	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3
Co-requisite	None				
Pre-requisite	None				
Data Books / Codes / Standards					
Course Category	PE Professional Elective				
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response	Know the significance of disaster management
2	Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives	Study the occurrences, reasons and mechanism of various types of disaster
3	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations	Learn the preventive measures as Civil Engineer with latest codal provisions
4	Critically understand different aspects of disaster management	Apply the latest technology in mitigation of disasters

Session	Description of Topic	Contact Hours	C-D-I-O	IOs
UNIT -1 (Introduction to Disaster Management)		**8**		
1	Definitions: Disaster, Emergency, Hazard, Mitigation, Disaster Prevention, Preparedness and Rehabilitation, Risk and Vulnerability	2	C, I	1
2	Classification of Disaster, Natural and Man-made Disasters, Disaster Management Act 2005	2	C, I	1
3	Role of NDMA, NDRF, NIDM	2	C, I	1
4	Risk and Vulnerability to Disaster Mitigation and Management Options: Concepts and Elements, Risk Assessment, Vulnerability, Warning and Forecasting	2	C, I	1
UNIT -2 (Hydro-meteorological based disasters)		**8**		
5	Tropical Cyclones, Floods, droughts, mechanism, Causes, role of Indian Metrological Department, Central Water Commission	2	C, I	2
6	structure and their impacts, classifications, vulnerability, Early Warning System,	2	C, I	2
7	Forecasting, Flood Warning System, Drought Indicators, recurrence and declaration, Structural and Non-structural Measures	2	C, I	2
8	Desertification Zones, causes and impacts of desertification, Characteristics, Vulnerability to India and Steps taken to combat desertification, Prevention.	2	C, I	2
UNIT -3 (Geological based disasters)		**8**		
9	Earthquake, Reasons, Direct and Indirect Impact of Earthquake; Seismic Zones in India, Factors, Prevention and Preparedness for Earthquake	3	C, I	3
10	Tsunamis, Landslides and avalanches: Definition, causes and structure; past lesson learnt and measures taken	2	C, I	3

11	their Characteristic features, Impact and prevention, structural and non-structural measures.	3	C, I	3
UNIT -4 (Manmade Disasters)		**8**		
12	Chemical Industrial hazards; causes and factors, pre and post disaster measures; control ; Indian Standard Guidelines and Compliance	2	C, I	4
13	Oil Slicks and Spills, Outbreak of Disease and Epidemics, Traffic accidents; classification and impact,	2	C, I	4
14	War and Conflicts; Fire risk assessment; Escape routes; fire fighting equipment;	2	C, I	4
15	**Use of remote sensing and GIS** in disaster mitigation and management	2	C, I	4
TOTAL CONTACT HOURS		**32**		

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	Thomas D. Schneid., Disaster Management and Preparedness, CRC Publication, USA, 2001
2	Patrick Leon Abbott, Natural Disasters, Amazon Publications, 2002
3	Ben Wisner., At Risk: Natural Hazards, People vulnerability and Disaster, Amazon Publications, 2001
4	Oosterom, Petervan, Zlatanova, Siyka, Fendel, Elfriede M., "Geo-information for Disaster Management", Springer Publications, 2005
5	Savindra Singh and Jeetendra Singh, Disaster Management, Pravalika Publications, Allahabad
6	Nidhi GaubaDhawan and AmbrinaSardar Khan, Disaster Management and Preparedness, CBS Publishers & Distribution
7	Selected Resources Published by the National Disaster Management Institute of Home Affairs, Govt. of India, New Delhi.

19ST2011	MATERIAL TESTING LABORATORY
Co-requisite	
Pre-requisite	19ST2001, 19ST2003
Data Books / Codes / Standards	
Course Category	
Course designed by	Department of Civil Engineering
Approval	

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course , student will be able to:		
1	To learn about IS mix design and its procedure	Student will be able to prepare a mix design as per IS Code
2	To learn about ACI mix design and its procedure	Student will be able to prepare a mix design as per ACI Code
3	To learn about Rebound Hammer test and it's methodology	Student will learn practical application of Rebound Hammer Test
4	To learn about Ultrasonic Pulse Velocity and it's methodology	Student will learn practical application of UPV
5	To conduct beam testing	Student will learn to test beam in flexure and analyse rsult

Session	**Description of Topic**	**Contact Hours**
1	Mix design by IS Code Method	6
2	Mix design by ACI code Method	6
3	Use of Rebound Hammer Test	6
4	Use of Ultrasonic Pulse Velocity	6
5	Bending testing of Beams	6
TOTAL CONTACT HOURS		30

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	IS codes & ACI codes.
2	

19ST2012	STRUCTURAL ANALYSIS AND DESIGN LAB	L	T	P	C
		0	0	4	2
Co-requisite					
Pre-requisite	19ST2001, 19ST2003.				
Data Books / Codes / Standards					
Course Category					
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to:		
1	Understand about Introduction to the use of Etabs.	To learn Etabs Software GUI
2	Understand about graphical interface Basic modeling- element types – meshing- Automatic Line Constraint	To do FE Modeling of Structures
3	Understand about Analysis for wind and earthquake analysis, including the response spectra analysis	Analysis models for various load combinations
4	Understand about Concrete Design Steel design with optimization	Design & optimization of structures
5.	Understand about Construction sequence loading including time dependent material properties	Design the model for worst loading conditions

Session	Description of Topic	Contact Hours
1	**Introduction**-Structure, types of structures, basic definitions, Idealization of structures	1
2	**About Etabs**- Features, hardware requirements, Etabs screen organization	1
3	**About Etabs** - GUI overview, Unit systems, Structure geometry and Coordinate systems (Global and Local)	1
4	**The Structural Model**-Units-Objects and Elements – Groups-Coordinate Systems and Grids-Properties -Load Cases	2
5	**The Structural Model** - Functions -Analysis Cases -Combinations – Design Settings -Output and Display Definitions	2
6	**The Graphical User Interface-**The Etabs Screen-Main Window-Menu Bar-Toolbars-Display Windows	1
7	**The Graphical User Interface**-Status Line-Using the Mouse –Viewing Options-Perspective - Pan, Zoom- and 3-D Rotate-Limits	1
8	**The Graphical User Interface-** Element View Options –Other Options- Refreshing the Display Window	1
10	**The Graphical User Interface** -Basic Operations- File Operations – Defining Named Entities-Drawing-Drawing Objects-Snap Tools – Drawing Controls -Selecting – Selecting Graphically	1

11	**The Graphical User Interface**-Selecting by Feature-Editing-Assigning-Undo and Redo-Analyzing-Displaying-Graphical Displays	1
12	**The Graphical User Interface**-Model Definition-Analysis Results-Function Plots-Tabular Displays	1
13	**The Graphical User Interface-**Designing-Locking and Unlocking-Entering Numerical Data-Setting Options	1
14	**Define Grid System**-Selecting Template-Entering Grid System Data-Adding Grid Lines in X, Y and Z Directions	1
15	**Define Material Properties**-Specify Design Parameters-Material Property Data	1
16	**Define Section Properties**-Add Frame Section Property-Specify Frame Section Properties for Beam	1
17	**Define Section Properties**-Add New Frame Section Properties for Column-Specify Area Section Properties for Slab	1
18	**Assigning Properties**-Assigning Properties to Frame Elements-Assigning Properties to Area Elements	1
19	**Assign Restraints**-Assigning Fixed, Pinned, Roller Support at Joints	1
20	**Define and Assign Load Cases**-Adding and Assigning Dead Load Case-Adding and Assigning Live Load Case	1
21	**Define and Assign Load Cases**-Adding and Assigning Wind Load Case-Adding and Assigning Seismic Load Case	1
22	**Defining Load Combinations-**Adding different Load Combinations for dead Load, Live Load, Wind Load and Seismic Load	1
23	**View Analysis Results in Tabular Form-**View Analysis Result Diagrams of Frame Elements-View Analysis Result Contour in Slab Panels	1
24	**Concrete Design-**Concrete Frame Design and View Design Results	3
25	**View Design Parameters**-View Load Combination for Concrete Frame Design	1
26	**View Design Parameters**-View Reinforcement for Frame Design-View Percenetage Steel for Frame Design	1
27	**Steel Design**-Steel Frame Design and View Design Results	2
28	**View Design Parameters**-View Load Combination for Steel Frame Design.	1
29	**Projects-**Concrete Structure	4
30	**Projects**-Steel Structure	4
	TOTAL CONTACT HOURS	40

LEARNING RESOURCE	
S.No.	**TEXT BOOKS**
1	MANUAL FOR ANALYSIS & DESIGN USING ETABS
2	

19ST2012	STAAD PRO	L	T	P	C
		0	0	4	2
Co-requisite					
Pre-requisite	19ST2001, 19ST2003.				
Data Books / Codes / Standards					
Course Category					
Course designed by	Department of Civil Engineering				
Approval					

PURPOSE		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to:		
1	Structural Analysis capabilities of STAAD Pro	To do modeling of Structures
2	Preprocessing, analysis and post-processing	To learn apply load as per IS codes
3	Working methodology of general finite element-based analysis software	Analysis models for various load combinations
4	Types of static and dynamic loadings	Design the model for worst loading conditions

Session	Description of Topic	Contact Hours
1	**Introduction to Structural Engineering**: Structure, types of structures, basic definitions, Idealization of structures	1
2	**About STAAD.Pro:** Features, hardware requirements, STAAD.Pro screen organization, GUI overview, Unit systems, Structure geometry and Coordinate systems (Global and Local).	1
3	**Model Generation**: Concept of Pre-Processor, Analysis Engine, Post Processor, creating a new file, creating nodes, Adding beam, plate, solid, enhanced grid tool (linear, radial, irregular), Geometry beam page	2
4	**Select Menu:** By All, By Inverse, By list, By specification, By missing attributes,	1
5	**Model Editing Tools:** Translational Repeat, Circular Repeat, Mirror, Rotate, Connect Beams Along, Stretch Selected Members, Intersect Selected Members Merge Selected Members	2
6	**Geometry Operations:** Insert Node: In existing member, adding beams, selecting members Renumbering, for a Single Member, For Multiple Members of Add Beam, Point to Point, Between Midpoints, Perpendicular Intersection, Curved Member, how to create Beam /Column & Curved Beams, Add Mid points, Add Perpendicular intersection beam	2
7	**Commands:** Support Specification, Member Property Specification, Member Offset, Material Specification, Group Specification, Release, Offset, Truss Only Tension Only, Compression Only	2

8	**Material Specifications:** Material Table, Modulus of elasticity, weight density ratio, Poisson's ratio, Co-efficient of thermal expansion, damping ratio; Member Offset	2
9	**Load Cases:** Primary Load menu, Load commands, Self-weight, Nodal load, Member load- concentrated force or moment, linear varying, trapezoidal, hydrostatic	2
10	**Analysis:** Perform analysis, run analysis	2
11	**Loading:** Area load, floor load, wind load, load combinations, seismic definitions	1
12	**Analysis of a structure:** Perform analysis, run analysis, pre analysis print, post analysis print	2
13	**Concrete Design:** Beam design, column design, design parameters- selection, defining parameters, assigning, end concrete design	3
14	**Modelling Plates in STAAD.Pro**: Geometry- adding plate, create infill plates, generate surface meshing, generate plate mesh, plate thickness,	2
15	**Loading:** Pressure on full plate, concentrated load, partial pressure on plate load	2
16	**Staircase design:** Common terminologies, modelling and design procedure	2
17	**Shear Wall Modelling and Design:** Adding surface, Commands; Surface thickness, surface load, design parameters, Load Cases: Member load- concentrated force or moment, linear varying, trapezoidal, hydrostatic	2
18	**Analysis:** Perform analysis, run analysis	1
19	**Analysis of a structure:** Perform analysis, run analysis, pre analysis print, post analysis print	4
20	**Steel Design:** Beam design, column design, design parameters- selection, defining parameters, assigning, Steel design	4
TOTAL CONTACT HOURS		40

LEARNING RESOURCE	
S. No.	**TEXT BOOKS**
1	
2	