

B. Tech. Semester IV

Subject Name: Structural Analysis

Subject Code: BTCL13404

Type of course: PCC-IV

Prerequisite: Theory of Structure

Rationale: This subject is a conceptual subject which applies the principles of mechanics of rigid and deformable bodies in the field of Engineering. It helps in determining response of statically determinate as well as indeterminate structures. Also the topics related to stability checks for structure subjected to lateral loads, buckling behavior of slender columns also help the students in developing the basic concepts of analysis of structures.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Fundamentals of Statically Determinate Structures: Types of statically determinate & indeterminate structures, static and kinematic indeterminacy, stability of structures, principle of superposition, Maxwell's reciprocal theorems. Computation of internal forces in statically determinate framed structures such as plane truss, plane frame, grids,	8	18
2.	Strain Energy : Resilience, strain energy stored in a body due to axial, shear loads & flexure, proof resilience, modulus of resilience, impact loads, and sudden loads	6	13
3.	Displacement of Statically Determinate structures: Differential equation of elastic curve, relation between moment, slope and deflection, Displacement of beam by Macaulay's method, Moment Area Method and Conjugate Beam Method.	7	16
4.	Direct and Bending stresses: Short columns subjected to eccentric loads, middle third rule, core or kernel of section, stress distribution, various applications of Direct & Bending	7	13

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	stresses i.e. chimneys subjected to wind pressure, Retaining walls subjected to earth pressure and Dams subjected to hydraulic pressure.		
5.	Columns and Struts : Buckling of columns, different end conditions, effective length, least radius of gyration ,Euler's and Rankine's formula, columns with initial curvature, eccentrically loaded columns, columns with lateral loading.	7	13
6.	Arches and Cables : Calculation internal forces in three hinged arches with circular and parabolic shapes subjected to various types of loading. Forces and end actions in cables due to various types of loading.	7	16
7	Thin cylinders and shells: Pressure in cylindrical shells, stresses and strains in thin cylinders, volumetric change in cylinder, thin spherical shells.	3	11

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	30	20	10	0

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels (**Revised Bloom's Taxonomy**)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Mechanics of Structures Vol-I;	Junarkar S.B. & Shah H.J	Charotar publishing house, Anand ISBN No:9789385039270	2016	32 nd
2	Analysis of structure Vol-1	V.N. Vazirani, M.M. Ratwani, Dr S.K. Duggal	Khanna Publications, New Delhi ISBN No:81-7400-140-8	2002	7 th
3	Theory of structures	R.S.Khurmi	S Chand & Co Ltd ISBN:10 8121905206 ISBN:13 978-8121905206	2020	1 st
4	Strength of Materials	Chakraborti M	S K KATARIA & SONS-NEW DELHI	2013	1 st

			ISBN: 9789350143759, 9350143755		
5	Strength of Materials	Ryder G.H	Palgrave Macmillan ISBN-10 0333109287 ISBN-13 978-0333109281	1961	1 st
6	Mechanics of Materials	M. G. James S. P. Timoshenko	CBS PUBLISHERS AND DISTRIBUTORS PVT LTD ISBN-13 978-8123908946	2018	1 st

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Apply principles of statics to determine reactions, internal actions in statically determinate framed structures including arches & cables. (U,A – Cognitive Level)	18
CO-2	Compute strain energy stored in member subjected to axial ,shear , flexural and torsional loads(U,A – Cognitive Level)	13
CO-3	Determine displacement in statically determinate beams by various approaches. (U,A – Cognitive Level)	16
CO-4	Carryout stability checks for various structures like chimney dams and retaining walls and differentiate the behavior of columns under different end conditions. (U,A – Cognitive Level)	26
CO-5	To calculate internal actions in statically determinate framed structures including arches, cables and stresses and strains in thin cylinders and shells. (U,A – Cognitive Level)	27

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO-2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO-3	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO-4	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO-5	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1
Rationale*	10	5	5	5	5	5	5	5	5	5	5	5	10	5	5

Rationale*: All CO's are compatible and matching to be derived POs to some extents. The subject helps in determining response of statically determinate as well as indeterminate structures.

List of Open Source/learning website:

- <https://nptel.ac.in/courses/105/105/105105166/>
 - Fundamentals of Statically Determinate Structures
 - Displacement of Statically Determinate structures
- <https://nptel.ac.in/courses/112/107/112107146/>
 - Strain Energy
 - Direct and bending stresses
- <https://nptel.ac.in/courses/105/105/105105109/>
 - Arches and Cables