SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology
Civil Engineering

B. Tech. Semester III

Subject Name: : Theory of Structures **Subject Code:** BTCL13305

Type of course: PCC-III
Prerequisite: Engineering Mechanics
Rationale: The subject deals with the ability to differentiate various types of stresses in a material under the action of external load, understanding the mechanical properties of materials .It will also form the base of subjects like structural analysis and design to be taught in the succeeding years.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
4	0	2	5	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.	**Simple stresses and strains:** Introduction, Stress,stain, Types of strain, Elasticity,Elastic limit,Stress strain diagram, Hooke's Law, Lateral, Longitudinal strain and Poisson's ratio,Volumetricstrain,Bulk modulus, Relation between bulk modulus and Young's Modulus, Allowable and working stresses, factor of safety, stresses in composite bars, bar of uniform strength	12	20
2.	**Shear Force and Bending Moments:** Definition and classification of beams, Types of loading, sign convention, Sheaf force, bending moment, relation between load shear force and bending moment, Shear force and bending moment diagrams for determinate beams, Point of contra flexure	12	20
3.	**Stresses in Beams:** Introduction, Pure bending, Theory of simple bending, Neutral Axis, Moment of resistance, Modulus of section, Shear stress in beams ,Shear stress distribution on various sections of beams.	10	17
4.	**Torsion:** Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity.	8	13

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5.	**Principal stresses:** Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications.	10	17
6.	**Mechanical Properties:** Elastic, homogeneous, isotropic materials; Stress –Strain relationships for ductile and brittle materials, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening, proof stress, factor of safety, working stress, load factor, Properties related to axial, bending, and torsional & shear loading, Toughness, Stiffness, hardness, Ductility ,Brittleness , Endurance Limit, Modulus of Rupture.	8	13

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**30**	**20**	**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 Solids	Dr H J Shah	Charotar Publishing House Pvt Ltd. Anand,Gujarat, India ISBN-978-81-85594-83-5 ISBN-978-88185594835	2008	1st
2	Mechanics of Solids	Dr. N K Arora	Books India Publications, Ahmedabagd, Gujarat,India ISBN-978-93-80867-05-2 ISBN-978-	2014	3rd

			9380867052		
3	Strength Of Materials	S Ramamurtham, R Narayan	DhanpatRaiPublihing Company Pvt. Ltd. ISBN-81-87433-54-X ISBN-978-8187433545	2000	13th
4	Strength Of Materials (Mechanics of Solids)	Dr. D S Kumar	S K Katariya and sons, New Delhi ISBN-978-93-5014-665-1 ISBN-978-9350146651	2018	1st
5	Mechanics of Structure Vol. I	S. B. Junnarkar& H. J. Shah	**Charotar Publishing House Pvt. Ltd. – Anand** ISBN-10 9380358652 ISBN-13 978-9380358659	**2016**	32nd
6	Strength of Materials	S S Rattan,	McGraw Hill Education pvt ltd New Delhi ISBN-10: 0-07-107256-X ISBN-13: 978-0-07-107256-4	**2011**	2nd

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Understand the different types of stresses and strains developed in the member subjected to axial, bending, shear, loads(R, U – Cognitive Level)	20
CO-2	Understand the behavior of beams (Flexural members) subjected to transverse loading(R, U – Cognitive Level).	37
CO-3	Understand the behavior of shaft under torsion(R, U – Cognitive Level)	13
CO-4	Analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle method. (U,A – Cognitive Level)	17
CO-5	Know the behavior & mechanical properties of engineering materials. (R, U – Cognitive Level)	13

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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 ability to make out the difference between the various types of stresses in a material under the action of external load will help in understanding the mechanical properties of materials.

LIST OF PRACTICALS: (Minimum 7 performed.)

1. Charpy/Izod Impact test.
2. Torsion test
3. Flexural strength Test
4. Ultimate tensile strength test
5. Compression test
6. Fatigue test
7. Brinell /Vicker/Rockwell Hardness test

Major Equipments:

1. Hardness testing machine
2. Impact testing machine
3. Universal testing machine
4. Fatigue testing Machine
5. Torsion testing Machine

List of Open Source/learning website:

- https://nptel.ac.in/courses/105/105/105105108/

- Simple stresses and strains
- Shear Force and Bending Moments
- Stresses in beams
- Torsion