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

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B.Tech. III Semester V

Subject Name : Advanced Strength of Material **Subject Code:** BTCL15501

Type of course : OE-I

Prerequisite : Engineering mechanics (BTCL12113)

Rationale : The course helps to understand the problems of elasticity and plasticity. It aims to evaluate the effect of torsion in structural components and also study the plastic deformation in the body.

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	**Introduction:** Analysis and Design, Conditions of Equilibrium, Definition and Components of Stress, Internal Force-Resultant and Stress Relations, Stresses on Inclined Sections, Variation of Stress within a Body, Plane-Stress Transformation, Principal Stresses and Maximum In-Plane Shear Stress, Mohr's Circle for Two-Dimensional Stress, Three-Dimensional Stress Transformation, Principal Stresses in Three Dimensions, Normal and Shear Stresses on an Oblique Plane, Mohr's Circles in Three Dimensions	7	15%
2	**Stress-strain:** Deformation, Strain, Equations of Compatibility, State of Strain at a Point, Engineering Materials, Stress-Strain Diagrams, Elastic versus Plastic Behavior, Hooke's Law and Poisson's Ratio, Measurement of Strain: Strain Rosettes, Strain Energy, Strain Energy in Common Structural Members, Components of Strain Energy	8	20%

OE-I : Open Elective -I

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3	**Bending Theory:** Pure Bending of Beams of Symmetrical Cross Section, Pure Bending of Beams of Asymmetrical Cross Section, Approximate Solutions, Theory of Bending, Normal and Shear Stresses, Composite Beams, Curved Beams, Elasticity Theory, Curved Beam Formula, Comparison of the Results of Various Theories	10	20%
4	**Failure Mechanism:** Failure, Failure by Yielding, Failure by Fracture, Yield and Fracture Criteria, Maximum Principal Stress Theory, Fracture Mechanics, Fracture Toughness, Failure Criteria for Metal Fatigue, Impact or Dynamic Loads, Dynamic and Thermal Effects	8	15 %
5	**Plastic Deformation** Idealized Stress-Strain Diagrams, Instability in Simple Tension, Plastic Axial Deformation and Residual Stress, Plastic Deflection of Beams, Analysis of Perfectly Plastic Beams, Elastic-Plastic Torsion of Circular Shafts, Plastic Torsion: Membrane Analogy, Elastic Plastic Stresses in Rotating Discs, Plastic Stress-Strain Relations, Plastic Stress-Strain Increment Relations, Stresses in Perfectly Plastic Thick Walled Cylinders	8	20%
6	**Mechanical Property Measurement:** Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength	4	10 %

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	15	25	25	20	5

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.

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Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of Publication	Publication Edition
1.	Strength Of Materials	S Ramamurtham, R Narayan	Dhanpat Rai Publishing Company Pvt. Ltd. ISBN-81-87433-54-X ISBN-978-8187433545	2000	13th
2.	Engineering Mechanics Statics and Dynamics	Shames/ Rao	Pearson Education India ISBN-10 : 8177581236 ISBN-13 : 978-8177581232	2005	4th
3.	Engineering Mechanics: Statics and Dynamics	Rajasekaran S	Vikas Publication, New Delhi. ISBN-10 : 8125918647 ISBN-13 : 978-8125918646	2005	3rd
4.	Engineering Mechanics Statics and Dynamics	N H Dubey	McGraw Hill Education ISBN-13 : 978-0071072595	2017	1st
5.	Applied Mechanics	Shah H. J. and Junarkar S. B.,	Charotar publication, Anand. ISBN : 9789385039065	2015	19th

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Interpret the response of materials and structural elements to applied forces of deformation. (*R, U ….Cognitive Level*)	25
CO-2	Explain the behavior of various materials (*A, N ….Cognitive Level*)	25
CO-3	Focus the behaviour of elastic and plastic material (*A, N ….Cognitive Level*)	25
CO-4	Justify the response of structure. (*N, E ….Cognitive Level*)	10
CO-5	Evaluate the various failure of structure. (*E, C ….Cognitive Level*)	15

Mapping with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1	1	2	1	3	3	2	2	1	3	1	1	3	1	3	2
CO-2	2	3	2	3	1	1	1	1	1	1	1	1	2	2	1
CO-3	1	1	1	1	1	3	3	3	2	2	1	2	3	1	1
CO-4	2	2	3	3	3	1	1	1	1	1	1	1	1	3	1
CO-5	1	1	1	1	1	2	1	2	1	2	3	3	2	1	3
Rationale*	**7**	**9**	**8**	**11**	**9**	**9**	**8**	**8**	**8**	**7**	**7**	**10**	**9**	**10**	**8**

OE-I : Open Elective -I

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Rationale*: The content of subject is inclined to evaluate the effect of torsion in structural components and also study the plastic deformation in the body.

LIST OF PRACTICALS:

1. Tension test
2. Bending tests on simply supported beam and cantilever beam.
3. Compression test on concrete
4. Impact test
5. Shear test
6. Determination of torsion and deflection
7. Measurement of strain in a bar
8. Bend test steel bar

List of Open Source/learning website:

1. https://nptel.ac.in/courses/112101095
2. https://nptel.ac.in/courses/112107146