

Course No:	Course Name:	L-T-P-Credits	Year of Introduction
SB201	MECHANICS OF SOLIDS	3-1-0-4	2016
<b>Prerequisites:</b> -Nil			
<b>Course Objectives:</b> <ol style="list-style-type: none"> <li>1. To impart understanding of the basic principles and foundations of Solid Mechanics.</li> <li>2. To give an ability to calculate stresses and deformations of objects under external loadings.</li> <li>3. To impart the ability to apply basic principles of Solid Mechanics to solve engineering problems.</li> </ol>			
<b>Syllabus:</b> Stress and Strain – Elastic Constants - Bending Moment and Shear Force Diagram – Stresses in Beams – Bending Stress – Shear Stress – Deflection of Beams - Thin Walled Pressure Vessels – Torsion in Circular Shafts – Theory of Columns- Principal Stresses- Failure criterion.			
<b>Expected Outcome:</b> At the end of the course students will be able to: <ol style="list-style-type: none"> <li>1. Understand the stresses and deformations caused by externally applied forces.</li> <li>2. Calculate elastic constants for a given material.</li> <li>3. Draw the bending moment and shear force diagram for a given beam and loads.</li> <li>4. Calculate the stresses and its distribution over the cross-section for a beam.</li> <li>5. Plot the elastic curve of a beam.</li> <li>6. Understand the concept of torsion and its application.</li> <li>7. Apply the buckling theory for the analysis of columns.</li> </ol>			
<b>Text Books:</b> <ul style="list-style-type: none"> <li>• Bansal R. K; Strength of Materials; Lakshmi Publications; New Delhi.</li> <li>• Timoshenko S. P.; Strength of Materials Part 1; D. Van Nostrand Company Inc .New York.</li> </ul>			
<b>Reference Books:</b> <ul style="list-style-type: none"> <li>• S. Ramamrutham, R. Narayan; Strength of Materials; Dhanpat Rai Publishing Company.</li> <li>• S. S Bavikatti; Strength of Materials; Vikas Publishing House Pvt Ltd., New Delhi.</li> <li>• Shames I. H., Pitarresi, James. M; Introduction to Solid Mechanics; Prentice Hall of India.</li> </ul>			
<b>Course Plan:</b>			
Module	Content	Hours	Sem. Exam Marks
I	<b>Basics:</b> Introduction to Mechanics of Solids; Types of Loads and Stresses; Definition of Uniaxial, Biaxial and Triaxial State of Stresses.	3	15%
	<b>Stress and Strain:</b> Tension, Compression and Shear; Uniaxial Stresses; Hooke's Law of Material Behaviour; Bar of Varying Cross section; Composite bar; Temperature Stresses; Poisson's Ratio; Stress - Strain Diagram; Working Stress, Factor of Safety; Volumetric Strain, Elastic Moduli and relationship between them.	6	

II	<b>Bending Moment and Shear Force:</b> Introduction to Types of Supports; Beams and Loads, Shear Force and Bending Moment Diagrams for Various Types of Statically Determinate Beams with Various Loading Combinations (Cantilever, Simply Supported and Overhanging Beams); Relation between Load, Shear Force and Bending Moment.	8	15%
FIRST INTERNAL EXAM			
III	<b>Stresses in Beams:</b> Theory of Simple Bending, Assumptions; Section Modulus, Flexural Rigidity; Stresses in Symmetrical Sections; Bending Stress Distribution.	5	15%
	<b>Shear Stress:</b> Shear stress Distribution in Beams, Assumptions; Stress in Various Cross Sections.	4	
IV	<b>Deflection:</b> Differential Equation of the Elastic Curve; Slope and Deflection of Beams by Method of Successive Integration; Moment Area Theorem.	8	15%
SECOND INTERNAL EXAM			
V	<b>Thin Walled Pressure Vessels:</b> Introduction; Biaxial Tension and Compression in Thin Walled Pressure Vessels (Cylindrical and Spherical).	4	20%
	<b>Torsion:</b> Introduction to Torsion - Torsion of Circular Shafts; Shear Stresses, Shear Deformation, Strain Energy.	4	
VI	<b>Theory of Columns:</b> Introduction to Columns; Buckling Theory, Euler's Formula for Long Columns, Assumptions and Limitations, Effect of End Conditions, Slenderness Ratio.	6	20%
	<b>Combined Stresses:</b> Principal Stresses and Planes, Mohr's Circle Representation of Stress in 2D problems. <b>Combined Loads:</b> Failures (Fracture, Yielding, Loss of Stability) - Hypothesis of Failure.	8	
END SEMESTER EXAM			

### QUESTION PAPER PATTERN:

#### PART A

- Answer all 8 questions of 3 marks each.
- 1 question each from modules I to IV and 2 questions each from modules V & VI.

#### PART B

- Answer any 2 full questions out of 3 for each module.
- Each question from module I to IV carries 6 marks.
- Each question from module V & VI carries 7 marks.
- Each full question can have maximum of 4 sub questions, if needed.