BMEE202L	Mechanics of Solids	L	T	P	C
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Pre-requisite	**BMEE201L**	**Syllabus version**			
		1.0			

Course Objectives

1. To understand the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behaviour.
2. To provide students with exposure on systematic methods for solving engineering problems in solid mechanics.
3. To discuss the basic mechanical principles underlying modern approaches for design of various structural members subjected to axial load, torsion, bending, buckling, transverse shear, and combined loading.
4. To build the necessary theoretical background for structural analysis and design courses.

Course Outcomes

At the end of the course, the student will be able to

1. Analyse stresses and strains in simple and compound bars, the importance of principal stresses, principal planes and failure theories
2. Illustrate the relationship among load, shear force and bending moment for various beams
3. Evaluate the bending and shear stresses for beams with varying cross sections
4. Calculate the slope and deflection of various beams
5. Apply torsion equation for shafts and helical springs
6. Analyse the failure of columns, thin and thick shells

Module:1	**Simple stresses and strains**	**9 hours**

Definition/derivation of normal stress, shear stress, and normal strain and shear strain – Stress-strain diagram for brittle and ductile materials - Poisson's ratio & volumetric strain – Elastic constants – relationship between elastic constants and Poisson's ratio – Generalised Hook's law – Deformation of simple and compound bars – Creep – Strain energy – Resilience – Gradual, sudden, impact and shock loadings – thermal stresses.

Module:2	**Bi-axial stress system**	**6 hours**

Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses and strain, Strain rosette – Principal stresses and strains – Analytical and graphical solutions. Theories of failures.

Module:3	**Shear Force and Bending Moment**	**6 hours**

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Module:4	**Stresses in beams**	**6 hours**

Theory of simple bending – Assumptions – Derivation of bending equation - Neutral axis – Determination of bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections, Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T sections.

Module:5	**Deflection of beams**	**5 hours**

Deflection of beams by Double integration method – Macaulay's method – Area moment theorems for computation of slopes and deflections in beams – Conjugate beam method.

Module:6	**Torsion**	**5 hours**

Introduction to Torsion – derivation of shear strain – Torsion formula – stresses and deformations in circular and hollow shafts – Stepped shafts – shafts fixed at the both ends,

stresses in helical springs.				
Module:7	**Thin and Thick Cylinders, Columns**			**6 hours**
Thin cylinders and shells – deformation of thin cylinders and shells; Thick Cylinders, Shrink fits, Compounding. Theory of columns – Long column and short column - Euler's formula – Rankine's formula.				
Module:8	**Contemporary Issues**			**2 hours**
	Total Lecture hours:			**45 hours**
Textbooks				
1.	Ferdinand P. Beer, E. Russell Johnston, John T. DeWolf, David F. Mazurek, Sanjeev Sangh, Mechanics of Materials, 2020, 8th Edition, McGraw Hill Education, India.			
2.	Russell C. Hibbeler, Mechanics of Materials in SI Units, 9th Edition; 2018, Pearson Education, India.			
Reference Books				
1.	James M. Gere, Barry J. Goodno, Mechanics of Materials, 2019, 9th Edition, Cengage Learning India Pvt. Ltd.			
2.	Rattan S. S., Strength of Materials, 2017, 3rd edition, McGraw Hill Education, India.			
3.	Ramamrutham S, Narayanan R, Strength of Materials, 2020, 20th Edition, Dhanpat Rai Publishing Company, India.			
4.	Popov E. P, Nagarajan S, Lu Z. A; Mechanics of materials, SI version, 2015, Prentice-Hall of India.			
5.	James M. Gere, and Stephen Timoshenko, Mechanics of Materials; 2004, 2nd edition, CBS publishers and distributors.			
Mode of Evaluation: CAT, Written assignment, Quiz , FAT				
Recommended by Board of Studies	09-03-2022			
Approved by Academic Council	No. 65	Date	17-03-2022	