Mechanics of Solids-1

Course Code	Credit Hours
CE 103	2-1

Course Description

This course is setup to introduce students with different types of stresses and strains. The students are thoroughly taught and trained to calculate and draw shear force and bending moment diagrams of various types of beams with different support conditions for static loads. Some initial techniques of analysis of structural elements are demonstrated with theoretical background and calculations

Text Book:

Strength of materials by Pytel A. & F.L. Singer, Latest Edition

Reference Book:

1. Mechanics of Solid**s** by Benham& Warnock, Latest Edition.
2. Mechanics of Materials by Egon P. Popov

Prerequisites :

Nil.

Assessment System for Theory

	Without Project (%)	With Project/Complex Engineering Problems (%)
Quizzes	15	10-15
Assignments	10	5-10
Mid Terms	25	25
Project	-	5-10
End Semester Exam	50	45-50

Assessment System for Lab

Lab Work/ Psychomotor Assessment/ Lab Reports	70%
Lab Project/ Open Ended Lab Report/ Assignment/ Quiz	10%
Final Assessment/ Viva	20%

Teaching Plan

Theory:

Week	Topic Covered	Reading Assignment/ Home Work	CLO No.	Assessment Methodology
1-2	**Introduction to different types of Stresses and Strains** • Normal stress and strain • Shear Stress and strain • Hooke's law • Poisson's ratio • Introduction to Internet of Things (IoT) applications in Strain measurements • Thermal stresses and strains	Ref 1, Chap 1	1	**Assignments, Quizzes, MSE, ESE**
3-5	**Force and Moment diagrams of determinate structures** • Shear force diagrams • Bending moment diagrams • Relation between load, shear force and bending moment • Stresses in composite sections	Ref 1, Chap 2 HW 1	1	
6-7	**Theory of bending stresses and shear stresses in beams** • Bending equation derivation • Shear equation derivation • Example Numerical	Ref 1, Chap 3 Quiz 1 , HW-2	1	
8	**Deflections of Beams** • Curvature, slope and deflection of beams using integration methods • Example Numerical	Ref 1, Chap 3 HW-3		
9	**Mid Semester Exam**			
10-12	**Theory of torsion** • Theory of torsion (Torsional equation) for solid and hollow circular shafts • Shearing stress distribution, angle of twist, strength and stiffness of shaft	Ref 1, Chap 8 Quiz 3	2	
13-17	**Stress and Strain Transformations** • Biaxial state of stresses • Resolution of stresses • Proncipal plane, principal stresses and strains	Ref 1, Chap 8 HW-4, Quiz 4		

	• Graphical representation of stress and strains, Hohr's circle of stresses and strains Shearing stress distribution, angle of twist, strength and stiffness of shaft			
13-15	**Columns** • Types of columns, (short, Intermediate and long), • Types of columns(Axially loaded short columns, (problems, pressures at the base of columns).	Ref 1, Chap 12 HW 4	2	
16-17	**Introduction to virtual work** • Strain energy due to direct loads; shear force, bending moment and torque • Stresses due to impact loads	Ref 1, Chap 8 Quiz 4	2	
17-18	**End Semester Exam**			

Practical:

S No.	**Practical**	**Assessment Methodology**	**Learning Domain/ Taxonomy Level**
1	To perform impact test on metal specimens	Project Reports, Lab Quiz, Viva	P3,A3
2	To perform compression test on wooden samples: a) When load is applied parallel to grains. b) When load is applied perpendicular to grains		P3,A3
3	To determine modulus of elasticity of different materials		P3,A3
4	To perform the bending test on wooden beams		P3,A3
5	To find out modulus of rigidity of different materials		P3,A3
6	To determine the crippling load for struts of varying slenderness ratios and end fixing conditions		P3,A3
7	To determine the tensile strength of bar		P3,A3
8	Determination of the compressive strength of cement		P3,A3
9	Determination of tensile strength of cement		P3,A3
10	Determination of yield strength, ultimate strength, rupture strength and percentage elongation of mild steel bar		P3,A3