COURSE PLAN

School : Engineering

Department : Mechanical Engineering

Course Code : ME201

Course Name : Solid Mechanics

Instructor: Dr. Dilip Datta

1. **Abstract:**

This is an introductory course on the material behaviors under different loading conditions. In the first part of the course, the students will be taught simple stresses and strains induced from different loadings, as well as their relationships with material properties. In the remaining part, the responses of materials will be covered under complicated loading conditions, such as twisting during load transmission, sharing, bending and deflection due to lateral loading, and buckling due to axial loading.

2. **Objective:**

The objective of this introductory course is to give the students the knowledge about the changing behaviors of materials under different simple and complicated loading conditions.

3. **Prerequisite of the Course:**

The prerequisite of this course is ME102 (Engineering Mechanics), in which students learn the states of rigid bodies under static and dynamic loadings.

4. **Course Outline + Suggested Reading:**

Module	***Topic***
1	Simple stress and strain
2	Transformations of stress and strain
3	Torsion
4	Shear force and bending moments diagram
5	Bending stress in beams
6	Deflection of beams
7	Energy methods
8	Column

***Suggested Reading*:**

a) F.P. Beer, E.R.R. Jhonston and J.T. DeWolf. *Mechanics of Materials*. Tata McGraw Hill, New Delhi, 2006.
b) S.S. Rattan. *Strength of Materials*. Tata McGraw Hill, New Delhi, 2009.
c) A. Pytel and F. L. Singer. *Strength of Materials*. Addision Wesley, 4/e, 1999.
d) E.P. Popov. *Engineering Mechanics of Solids*. PHI, 2/e, New Delhi, 2009.

5. (a) Time Plan:

SN	*Contents*	*L+T*
1	***Simple Stress and Strain*:** Introduction, stress at a point, types of stresses, strain, shear and normal strains, stress-strain diagram, true stress and true strain, Hooke's law, Poisson's ratio, material properties for isotropic materials and their relations, generalized Hooke's law, stress-strain relationship, statically indeterminate systems, stresses induced in compound bars, thermal stress and strain.	6+2=8
2	***Transformations of Stress and Strain*:** Components of stress, stress on inclined plane, transformation of plane stress, principal stresses and principal planes, maximum shear stress and plane of maximum shear stress, Mohr's circle for plane stress, stresses in thin-walled pressure vessels, principal strains, direction of principal strains and maximum shear strain, Mohr's circle for plane strain.	6+2=8
3	***Torsion*:** Introduction, circular shaft under torsion, stepped shaft and shaft of varying sections, shafts in series and parallel.	3+1=4
4	***Shear Force and Bending Moments Diagram*:** Introduction, beams, relation between load, shear force and bending moment, drawing of shear force and bending moment diagram for different loading condition of beams.	6+2=8
5	***Bending Stress in Beams*:** Pure bending, neutral axis, theory of simple bending (bending equation of beam), section modulus, shear stress in bending, variation of shear stress along the depth of the beam for different sections.	6+2=8
6	***Deflection of beams*:** Introduction, elastic curve, slope and deflection at a point - double integration method, principle of superposition, Macaulay's method, area moment method.	6+2=8
7	***Energy Methods*:** Introduction, strain energy, toughness, resilience, strain energy due to axial, torsion, bending and transverse shear, Castigliano's theorem, reciprocity theorem.	3+1=4
8	***Column*:** Introduction, Euler critical (buckling) load for long columns, effective or equivalent length, slenderness ratio.	3+1=4
	Total contacts	**39+13=52**

(b) Evaluation Plan:

(i) Class test/quiz (02 numbers) = 25 Marks
(ii) Home assignment = 15 Marks
(iii) Class attendance = 10 Marks
(iv) Mid Semester Examination = 30 Marks
(v) End Semester Examination = 70 Marks

6. Pedagogy:

(a) Teaching-learning methods will be adopted in a way to support the discussion on each module by 1 or 2 tutorial class(es) for better understanding.
(b) Learning of the students will be evaluated through assignments, class test/quiz, and examinations.
(c) Teaching of the instructor will be evaluated by the students through a questionnaire.

7. Expected Outcome:

From this course, students would learn material behaviors under different loading conditions, which would form their foundation for designing machine components.