

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD
CAMPUS**

FIRST SEMESTER 2023-2024

Course Handout (Part II)

Date: 11/08/2023

In addition to Part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : ME F211
Course Name : Mechanics of Solids
Instructor-in-charge: AMIT KUMAR GUPTA
Instructors : A K Gupta, Aditya Nema, TBA-1, TBA-2, TBA-3
Lecture schedule: Mon, Wed, Fri – 3 (10-11 AM) @ F-103
Tutorial schedule: Tue – 1 (8-9 AM) @ F-102

1. Course Description:

Fundamental principles of mechanics, introduction of mechanics of deformable bodies, force and moment transmitted by slender members (2D truss, frame, beam), stress and strain, stress-strain-temperature relations, torsion of circular member, stress and deflection due to bending, buckling of columns, theories of failure.

2. Scope and Objective:

The subject of mechanics of solids deals with determination of strength, deformation and stability of structural and machine elements. The methods are based on Laws of Newtonian mechanics, applied to bodies in static equilibrium, geometry and experimentation. These laws are applied to simple situations with engineering judgment to arrive at results of significance to the designer. At the end of the course the student will be in a position to design and analyze simple structural elements, which involve calculation of stress, strain and deformation. This is an essential feature in any design process.

3. Text Books:

S. H. Crandall et al., An Introduction to the Mechanics of Solids (in SI units) TMH, 3rd ed., 2012

4. Reference Books:

1. Mechanics of Materials; F. P. Beer, E. R. Johnston and J. T. DeWolf, Third Edition, 2002, McGraw-Hill International Edition.
2. Mechanics of Solids, AN INTRODUCTION, T. J. Lardner, R R Archer, International Edition, 1994, McGraw-Hill
3. Introduction to Solid Mechanics by I. H. Shames, 2nd Edition, 1980, Prentice Hall of India Private Ltd. New Delhi.

5. Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Reference Chap./Sec.
1-3	Fundamental principles of mechanics	Introduction, principles of mechanics, concept of force & moment, equilibrium conditions, concept of 2 & 3 force members, free body diagram	1.1-1.7 (TB)
4-8	Introduction to mechanics of deformable bodies	Analysis of deformable bodies, uniaxial loading & deformation, statically determinate & indeterminate situations, Castigliano's theorem.	2.1-2.5 2.7 (TB)
9-11	Forces & moments transmitted by slender members	Introduction forces & moments acting on a section of a member, distributed loads & resultant of distributed loads	3.1-3.4 (TB)
12-14	Forces & moments transmitted by slender members	Differential equilibrium approach, Singularity functions	3.5-3.6 (TB)

15-17	Stress & Strain	Introduction, stress, plane stress, equilibrium of a element in plane stress, Mohr circle representation of a plane stress, general state of stress.	4.1-4.7 (TB)
18-20	Stress & Strain	Analysis of deformations, strain components, relation between strain & displacement, strain component associated with arbitrary set of axis, Mohr circle representation of plane strain, general state of strain	4.8-4.13 (TB)
21-22	Stress-Strain-Temperature relations	Introduction, tensile test, idealization of stress strain curve, elastic stress strain relation	5.1-5.4 (TB)
23-25	Stress-Strain-Temperature relations	Thermal strain, complete equations of elasticity, strain energy in a elastic body, criteria of initial yielding	5.5-5.6, 5.8,5.11 (TB)
26-29	Torsion	Introduction, geometry of deformation of a twisted circular shaft, stress strain relations, equilibrium requirements, stresses & deformations in twisted elastic circular shaft, torsion of elastic hollow circular shaft, combined stresses, strain energy due to torsion, yielding in torsion	6.1-6.9 (TB)
30-31	Stresses due to bending	Introduction, deformation in pure bending, stress-strain relations, equilibrium requirements, stresses & deformations in pure bending	7.1-7.5 (TB)
32-34	Stresses due to bending	Stresses due to shear force and bending moment, combined stresses, strain energy due to bending, yielding in bending	7.6-7.9 (TB)
35-36	Deflections due to bending	Introduction, moment-curvature-relations, integration of moment-curvature relations, superposition	8.1-8.4 (TB)
37-38	Deflections due to bending	Load-deflection differential equation, Energy Methods	8.5-8.6 (TB)
39-40	Stability of equilibrium buckling	Introduction, elastic stability, examples of instability, elastic stability of flexible columns	9.1-9.4 (TB)

6. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date & Time	CB/OB
1.	Mid-Sem. Test	90 min	25 %	11/10 - 9.30 - 11.00AM	CB
2.	Lecture class participation	---	10 %		OB
3.	Tutorial class participation	---	15 %		OB
4.	Quizzes	---	10 %		OB
5.	Compre. Exam.	180 min	40 %	12/12 FN	CB

7. Chamber Consultation Hour: Every Tuesday 4 – 5 PM

8. Notices: All notices will be displayed on the **CMS**.

9. Make up Policy: Make-up will be granted only to genuine cases with prior permission from the IC. For cases related to illness, proper documentary evidence is essential. No makeup is allowed for EC2, EC3, & EC4.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester. Any form of academic dishonesty would lead to serious actions.

Instructor-in-charge
ME F211