

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS**  
**FIRST SEMESTER 2021-2022**  
**Course Handout (Part II)**

Date: 20/08/2021

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** : **Dr. Pavan Kumar P**  
**Instructors** : **Dr. Pavan Kumar P, Jagan Mohan, Sangam Srikanth, Murali Mohan, Laxmana Rao Kolla**

**1. Course Description:**

Fundamental principles of mechanics; Introduction to the mechanics of deformable bodies; Forces and Moments transmitted by slender members; Stress- Strain; Stress-Strain Temperature relations; Torsion of circular member; Stresses and deflections due to bending; Stability of equilibrium, 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, 3<sup>rd</sup> 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, 2<sup>nd</sup> Edition, 1980, Prentice Hall of India Private Ltd. New Delhi.
4. Mechanics of Materials, Madhukar Vable, 2002, Oxford University,

**5. Course Plan:**

Lecture No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1-3	Fundamental principles of mechanics	Introduction, principles of mechanics, concept of force & moment, equilibrium conditions, concept of two & three force members, free body diagram, friction	1.1-1.9 (TB)
4-5	Fundamental principles of mechanics	Numerical problems	Ch.1 (TB)
6-8	Introduction to mechanics of deformable bodies	Analysis of deformable bodies, uniaxial loading & deformation, statically determinate & indeterminate situations, Castigliano's theorem.	2.1-2.4 2.6-2.7 (TB)
9-10	Introduction to mechanics of deformable bodies	Numerical problems	Ch.2 (TB)
11-12	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)
13-14	Forces & moments transmitted by slender members	Differential equilibrium approach, Singularity functions	3.5-3.6 (TB)

15-16	Forces & moments transmitted by slender members	Numerical problems	Ch.3 (TB)
17-18	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)
19-20	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	Numerical problems	Ch.4 (TB)
23-24	Stress-Strain-Temperature relations	Introduction, tensile test, idealization of stress strain curve, elastic stress strain relation	5.1-5.4 (TB)
25-26	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)
27	Stress-Strain-Temperature relations	Numerical problems	Ch.5 (TB)
28-30	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 & Numerical	6.1-6.9 (TB)
31	Torsion	Numerical problems	Ch.6 (TB)
32-33	Stresses due to bending	Introduction, deformation in pure bending, stress-strain relations, equilibrium requirements, stresses & deformations in pure bending	7.1-7.6 (TB)
34-35	Stresses due to bending	Stresses due to shear force and bending moment, combined stresses, strain energy due to bending, yielding in bending	7.7-7.9 (TB)
36	Stresses due to bending	Numerical problems	Ch. 7
37-38	Deflections due to bending	Introduction, moment-curvature-relations, integration of moment-curvature relations, superposition	8.1-8.4 (TB)
39-40	Deflections due to bending	Load-deflection differential equation, Energy Methods, Numerical problems	8.5-8.6 (TB)
41	Deflections due to bending	Numerical problems	Ch. 8
42-43	Stability of equilibrium buckling	Introduction, elastic stability, examples of instability, elastic stability of flexible columns	9.1-9.4 (TB)
44	Stability of equilibrium buckling	Numerical problems	Ch.9

#### 6. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
1	Midsem test	90 Min	30%	23/10/2021 11.00 - 12.30PM	OB
2	Tutorials Assignments	---	20%		OB
3	Quizzes	--	10%		OB
4	Compre. Exam.	120 Min	40%	27/12 FN	OB

**7. Chamber Consultation Hour:** Will be announced by instructors individually in the class.

**8. Notices:** Notice, if any, 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 Quizzes and assignments.

**10. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**  
**ME F211**