

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
SECOND SEMESTER 20242025
Course Handout Part II

Date:30/12/2024

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 F218

Course Title : Advanced Mechanics of Solids

Instructor-in-charge : Dr. Amol Vuppuluri

Co-Instructor : Dr. Brajesh Panigrahi

Bulletin wise contents: 3D stress, strain, and generalized Hooke's law, energy methods, torsion of noncircular members, shear center and asymmetrical bending, curved beams, and thick cylinders.;

1. Scope and Objective of the Course:

The course deals with analysis of some advanced topics in Mechanics of Solids, beyond what is covered in the basic course of Mechanics of Solids ME F 211.

2. Course Description:

The course work starts with **Generalized Hooke's law** and **Three Dimensional Stress Strain Relations**. Then a detailed discussion of energy methods for solving **indeterminate problems** is included. Theory related to **non-circular** members subjected to **torsion** is treated. Theories of **Asymmetrical Bending, Shear Centre, Curved Beams** and **Thick Cylinders** are dealt with in later chapters.

3. Text books:

T1: "Advanced Mechanics of Materials" - Arthur P., Boresi and R.J. Schmidt, John Wiley, 6th Edition, 2003.

Reference books:

R1: "Advanced Mechanics& Solids" L.S. Srinath, Tata McGrawHill Publishing Co. 2nd Edition, 2003

R2: "Advanced Mechanics of Solids" – Otto T. Bruhns, Springer Verlag, 2003

R3: "Advanced Mechanics of Materials" – R. Davis Cook and Warren C. Young, Prentice Hall 2nd Edition, 1998.

4. Course Plan

Lect. No.	Learning Objectives	Topics to be Coursed	Chap/Sec
1	Review of elementary Mechanics of Materials and methods of analysis, failure analysis & properties of material	Introduction & review of elementary mechanics of solids	CH1(TB)
2 to 5	Three dimensional stress strain relations and tensor representation. Generalized Hooke's law. Hook's law for Anisotropic elasticity, Isotropic elasticity and Orthotropic materials	Theories of stress strain & Generalized Hooke's Law	CH2 (TB) & CH3 (TB)
6 to 9	Principle of potential energy, Castigliano's theorem, Deflections in statically determinate structures and statically indeterminate structures, applications to curved	Energy methods and applications	CH5 (TB)

	beam treated as straight beams.		
10 to 15	Torsion of Prismatic bar of circular cross section, Example problems, Saint-Venant's Semiinverse method, Linear Elastic solutions, Torsion of Rectangular cross section members, hollow thin wall torsion members, Numerical solution of torsion problems	Non-circular members subjected to torsion	CH6 (TB)
16 to 19	Non-symmetrical loading bending and deflection of straight beams. Deflections in standard channel sections	Asymmetrical bending	CH7 (TB)
20 to 24	Shear in Thin walled beams, Shear flow in thin-walled beam cross sections, Shear center for channel sections and Shear center for composite beams.	Shear Centre	CH8 (TB)
25 to 28	Location of neutral axis, radial stress, correction of circumferential stress and deflections of curved beams. Curved beams of standard sections: I & T. Analysis of statically indeterminate curved beams (closed ring) and thick cylinders	Curved beams & Thick walled cylinders	CH9 (TB) & CH11(TB)

5. Evaluation Scheme:

EC No	Evaluation Component	Duration (min.)	Weightage (%)	Date & time	Nature of component
1	Midsemester Exam	90	30	As announced in Time Table	CB
2	Tutorials		15	Throughout the semester	OB
3	Quiz		15	Will be conducted by IC during anytime in the class/tutorial hours	OB
4	Comprehensive Exam	120	40	As announced in Time Table	CB

6. Consultation Hour: To be announced in the class.

7. Notices: All the notices will be displayed in CMS. Besides this, students are advised to visit regularly CMS (institute's web based course management system) for latest updates.

8. Make-up policy: Make-up shall be given only to the genuine cases with prior intimation. No makeup is allowed for tutorials and quiz.

9. 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 and instructors
ME F218**