

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2020-2021
Course Handout Part II

Date: 17/08/2020

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 F312

Course Title : Advanced Mechanics of Solids

Instructor-in-charge : Dr. Pavan Kumar P

Bulletin wise contents: Generalized Hooke's law; Energy methods; Torsion of non-circular members; Shear center and Asymmetrical bending; Curved beams; Thick cylinders; Plates and shells; Contact stress.

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. A chapter with a brief study on **Contact Stress** is also included.

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 McGraw-Hill 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&2	Review of elementary Mechanics of Materials and methods of analysis, failure analysis & properties of material	Introduction & review of elementary mechanics of solids	CH1(TB)
3 to 6	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)
7 to 10	Principle of potential energy, Castigliano's theorem, Deflections in statically determinate structures and statically indeterminate structures, applications to curved beam treated as straight beams.	Energy methods and applications	CH5 (TB)
11 to 16	Torsion of Prismatic bar of circular cross section,	Non-circular	CH6 (TB)

Lect. No.	Learning Objectives	Topics to be Coursed	Chap/Sec
	Example problems, Saint-Venant'sSeminiverse method, Linear Elastic solutions, Torsion of Rectangular cross section members, hollow thin wall torsion members, Numerical solution of torsion problems	members subjected to torsion	
17 to 20	Non-symmetrical loading bending and deflection of straight beams. Deflections in standard channel sections	Asymmetrical bending	CH7 (TB)
21 to 25	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)
26 to 32	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).	Curved beams	CH9 (TB)
33 to 35	Stress – Stain – Temperature relation for thick walled cylinders and composite cylinders. Analysis of open and closed cylinders	Thick walled cylinders	CH11(TB)
36 to 38	Stress resultants, strain-displacment relations in flat plates and shells	Plates and shells	CH13(TB)
39 to 42	Geometry of contact surface, methods of computing contact stress, deflection of bodies in point contact and line contact with normal load.	Contact stress	CH17(TB)

5. Evaluation Scheme:

EC No	Evaluation Component	Duration (min.)	Weightage (%)	Date & time	Nature of component
1	Test-1	30	15	September 10 – September 20 (during scheduled class Hour)	OB
2	Test-2	30	15	October 9-October 20(during scheduled class hour)	OB
3	Test-3	30	15	November 10-November 20 during scheduled class hour)	OB
4	Tutorial tests		20		OB
5	Comprehensive Exam	120	35	TBA	OB

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 tutorial surprise tests.

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.

Dr.Pavan Kumar P
ME F312