FIRST SEMESTER 2015-2016

Course Handout Part II

Date: 02/08/2015

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 : **Prof. M. S. DASGUPTA**

Tutorial Instructors : Dr. Murali Palla, Dr. Sandeep Dhar

1. Course Description: The course starts with generalized Hooke's law and three dimensional stress strain relations putting emphasis on Materials-Mechanics linkage to elucidate mechanical properties of materials. It also includes Energy methods; Torsion of non-circular members; Shear center and Asymmetrical bending of beams; Curved beams; Thick cylinders; Plates and shells; Contact stress.

2. **Scope and Objective of the Course:** The course deals with in-depth analysis of some advanced topics in Mechanics of Solids, necessary for Mechanical Engineering students, beyond what is covered in the common course Mechanics of Solids.

3. **Text books:**

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

Reference books:

R1: "Advanced Mechanics & Solids" - L.S. Srinath, Tata Mc.Graw-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. Lecture Plan:

Lect. No.	Learning Objectives	Topics to be Coursed	Chap/Sec. (Book)
1	Review of elementary Mechanics of Materials and methods of analysis,	Introduction & review of elementary mechanics of solids, methods of	CH1 (TB1)

	failure analysis & properties of material	analysis, failures in design	
2-6	Energy methods and applications	Principle of stationary potential energy, Castigliano's theorem, Deflections in statically determinate structures and statically indeterminate structures, applications to curved beam treated as straight beams.	CH5 (TB1)
7-12	Theories of stress and strain	Stress at a point, stress on an arbitrarily oriented plane, transformation of stress, principal stresses, differential equations of motion of a deformable body, deformation, strain theory, small displacement theory	CH2 (TB1)
12-16	Linear stress strain temperature relations.	Generalized Hooke's Law, anisotropic and isotropic elasticity, thermoelasticity for isotropic materials, Hook's law for orthotropic material	CH3 (TB1)
17-22	Torsion of non-circular member	Torsion of prismatic bar, Saint Venant's Semi-inverse method, linear elastic solutions, Prandtle elastic membrane analogy torsion of rectangular cross section	CH 6.1-6.6 (TB1)
23-25	Asymmetrical bending	Non-symmetrical loading bending and deflection of straight beams.	CH7.1-7.3(TB1)
26-28	Shear Center for thin walled beam cross sections	Shear flow in thin-walled beam cross sections , Shear Center for channel section	CH 8.1-8.3 (TB1)
29-31	Curved beams	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).	CH9.1-9.6 (TB1)

32-33	Thick walled cylinders	Stress – Stain – Temperature relation for thick walled cylinders and composite cylinders. Analysis of open and closed cylinders	CH11 (TB1)
34-37	Flat Plates	Stress resultants in a flat plate, kinematics, equilibrium equations, stress strain temperature relations, strain energy of a plate, boundary conditions, solution of rectangular and circular plate problems	CH 13 (TB1)
38-40	Contact stress	Geometry of contact surface, methods of computing contact stress, deflection of bodies in point contact and line contact with normal load.	CH17 (TB1)

Evaluation Scheme :

EC No	**Evaluation Component**	Duration (min.)	Weightage	Date, time & Venue	Nature of component
1	Surprise tests	-	10		CB
2	Mid-semester Test	90	25	***4/10 10:00 - 11:30 AM***	OB
3	*Tutorials	50	15	Tutorial hour as announced in Timetable, OB	
4	Comprehensive Exam	180	50	3/12 FN	CB & OB

* Tutorials will be utilized for numerical problem solving and computer assisted problem solving under guidance of tutorial instructor and the same will be evaluated. Best **four** performances out of evaluated ones for each student will be counted for aggregate marks.

Chamber Consultation Hour: To be announced in the class.

Notices: If any, will be displayed in Mechanical Engineering notice board only.

Make-up policy: No makeup is allowed for Tutorials / Surprise test.

Instructor-in-charge

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