SECOND SEMESTER 2020-2021

Course Handout Part II

Date: 15/01/2021

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

LPTU ***: 2012***
Course No. : ME F218
Course Title : Advanced Mechanics of Solids

Instructor-in-charge : **Prof. M. S. DASGUPTA**
Tutorial Instructors : J S Rathore, Gaurav Watts, Venkatesh Kadbur Prabhakar Rao

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.

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:

Class	*Module*	**Lecture Session & Tutorial Session**	**Chap/Sec (Book)**	**Learning Outcome**

1	Review of elementary Mechanics of Materials and methods of analysis, failure analysis & properties of material	Introduction & review of elementary mechanics of solids, methods of analysis, failures in design. **Tutorial 1**	CH1 (TB1)	Quick revision of Important Concepts in First level course on Engg. mechanics
2-4	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. **Tutorial 2**	CH5 (TB1)	Ability to identify, formulate and solve variety problems of statics using energy method
5-9	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 **Tutorial 3 & 4**	CH2 (TB1)	Comprehend nuance of continuum mechanics, its implications and numerical problem solving.
10-12	Linear stress strain temperature relations.	Generalized Hooke's Law, anisotropic and isotropic elasticity, thermoelasticity for isotropic materials, Hook's law for orthotropic material **Tutorial 5**	CH3 (TB1)	Computing stress and strain for anisotropic material

13-17	Torsion of non-circular member	Torsion of prismatic bar, Saint Venant's Semi-inverse method, linear elastic solutions, Prandtle elastic membrane analogy **Tutorial 6**	CH 6.1-6.6 (TB1)	Formulation and solution of stress arising out of torsion in a general structural member.
18-21	Asymmetrical bending	Non-symmetrical loading, bending and deflection of straight beams **Tutorial 7**	CH7.1-7.3(TB1)	Formulation and solution of stress arising out of bending in a general structural member.
22-23	Shear Center for thin walled beam cross sections	Shear flow in thin-walled beam cross sections, Shear Center for channel section. **Tutorial 8**	CH 8.1-8.3 (TB1)	Appreciate the concept of Shear center computation of same.
24-25	Curved beams	Location of neutral axis, radial stress, correction of circumferential stress and deflections of curved beams. **Tutorial 9**	CH9.1-9.6 (TB1)	Appreciate the concept and compute bending stress in a beam with finite radius of curvature.

Evaluation Scheme :

Evaluation Component	Weightage (%)	Duration (Minutes)	Date of Evaluation
Mid Semester Test	30	60	
Tutorial	30	-	Evenly spaced throughout the semester
Comprehensive Examination	40	120	As announced in the Timetable

* Tutorials will be utilized for numerical 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 Nalanda.

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

Instructor-in-charge

ME F218