**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**

**SECOND SEMESTER 2023‑2024**

**Course Handout Part II**

#### Date:09/01/2024

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. Brajesh Kumar Panigrahi

***Co-Instructor***: Dr. Amol Vuppuluri

**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.

1. **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 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 | 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 beam treated as straight beams. | Energy methods and applications | CH5 (TB) |
| 10 to 15 | Torsion of Prismatic bar of circular cross section, 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 | 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 | 11/03 - 2.00 - 3.30PM | **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 | 180 | 40 | 07/05 FN | **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**