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**FIRST SEMESTER 2023-2024**

Course Handout Part II

Date: 11-08-2023

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 : CE F211**

**Course Title : Mechanics of Solids**

**Instructor-in-Charge : RAGHU PISKA**

**1. Course Description:**

Fundamental principles of mechanics; Introduction to the mechanics of deformable bodies; Thermal stresses, equilibrium of forces, analysis of determinate trusses, bending moment and shear force diagrams for determinate beams and frames, flexural and shear stresses in beams, combined stresses, stresses and strains on inclined planes, Introduction to energy methods, stresses in thin cylindrical shells, suspension cables, Forces and Moments transmitted by slender members; Stress- Strain; Stress-Strain Temperature relations; Torsion; stresses and deflections due to bending; Failure theories, Buckling of columns using Euler’s Theory.

**2. Scope and Objective of the Course:**

Mechanics of solids deals with study of the mechanical behavior of structural and machine elements. The methods are based on Laws of Newtonian mechanics, applied to bodies in static equilibrium. The mechanical study of materials gives insights for the efficient design of different structural elements.

At the end of the course the student will be in a position to design and analyze simple structural elements such as truss element, beam, which involve calculation of stress, strain and deformation.

**3. Text Books**:

**1**. Mechanics of materials by R.C. Hibbeler, 10th edition, Pearson publication

**4. Reference Books:**

**1.** Engineering Mechanics of Solids, Egor P. Popov, 2nd Edition, 1998, PHI, India.

2.Mechanics of Materials; F. P. Beer, E. R. Johnston, J. T. DeWolf and D. F. Mazurek, Fifth Edition, 2011, McGraw-Hill Education Pvt. Ltd., India.

**3.** Mechanics of Materials, James M. Gere, 6th Edition, 2006, Thomson Books/Cole, USA.

Course Plan:

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| **Module No.** | **Lecture Session** | **Reference** | **Learning outcomes** |
| 1-3 | Introduction, principles of mechanics, concept of force & moment, equilibrium conditions, concept of two & three force members, free body diagram, concept of stress and strain | Ch. 1-3  (TB) | Fundamental principles of mechanics |
| 4-6 | Numerical problems | Ch.1-3 (TB) | Fundamental principles of mechanics |

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| 7-10 | Analysis of deformable bodies, uniaxial loading & deformation, statically determinate truss, thermal stress | Ch. 4  (TB) | Introduction to mechanics of  deformable bodies |
| 11-12 | Numerical problems | Ch.4 (TB) | Introduction to mechanics of  deformable bodies |
| 12-14 | Bending moment and shear forces in beams and frames | Ch. 6  (TB) | Forces & moments transmitted by slender members |
| 14-15 | Differential equilibrium approach, Singularity functions | Ch. 6  (TB) | Forces & moments transmitted by slender members |
| 16-17 | Numerical problems | Ch.6 (TB) | Forces & moments transmitted by slender members |
| 18-20 | Flexural and shear stresses in beams | Ch. 6  (TB) | Types of stresses in beams |
| 21-23 | Analysis of deformations, strain components, relation between strain & displacement, strain component associated with arbitrary set of axis, Mohr circle representation of plane strain, general state of strain, Mohr circle | Ch. 9-10  (TB) | Stress & Strain |
| 24-26 | Numerical problems | Ch.9-10 (TB) | Stress & Strain |
| 26-28 | Thermal strain, complete equations of elasticity, strain energy in a elastic body, criteria of initial yielding and numerical problems | Ch. 4  (TB) | Stress-Strain-Temperature relations |
| 29 | Numerical problems | Ch.4 (TB) | Stress-Strain-Temperature relations |
| 30-31 | Introduction, geometry of deformation of a twisted circular shaft, stress strain relations, equilibrium requirements, stresses & deformations in twisted elastic circular shaft, torsion of elastic hollow circular shaft, combined stresses | Ch.5  (TB) | Torsion |
| 32 | Numerical problems | Ch.5 (TB) | Torsion |
| 33-36 | Slope and deflection calculation in beams due to bending and energy methods | Ch.12 | Deflections due to bending |
| 37 | Numerical problems | Ch. 12 | Deflections due to bending |
| 38-39 | Stresses in thin cylindrical shells and suspension cables | Ch. 8  (TB) | Analysis of cylindrical shells |
| 40-42 | Failure theories and buckling of columns | Ch. 13  (TB) | Buckling of columns and failure theories |

**6. Evaluation Scheme**:

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| **Sl.**  **No.** | **Evaluation**  **Component** | **Duration** | **Weightage** | **Date, Time &Venue** | **Nature of**  **Component** |
| 1. | Mid-semester | 1.5 hrs | 30% | 14/10 - 2.00 - 3.30PM | CB |
| 2. | Assignments (including class assignments) | –– | 10% |  | –– |
| 3 | Surprise quizzes |  | 15% |  | OB |
| 3. | Compre. Exam. | 3 hrs | 45% | 21/12 FN | OB |

**7. Chamber Consultation Hour**: Monday, Tuesday and Friday 4:30 PM

**8. Notices:** Notice, if any, concerning the course will be displayed on the Google classroom.

**9. Make-up Policy:** Make-up will be granted only to genuine cases. For cases related to illness, proper documentary evidence is essential. **Prior permission** is necessary for all makeup requests. **No make up for tutorial tests.**

**10. 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**

**Course No. CE F211**