

MECHANICS OF SOLIDS

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|--|-------------------|---------------------------------|-------|----------------------|-----------------------|
| Course Code | 23ME3301 | Year | II | Semester | I |
| Course Category | Professional Core | Branch | ME | Course Type | Theory |
| Credits | 3 | L-T-P | 3-0-0 | Prerequisites | Engineering Mechanics |
| Continuous Internal Evaluation: | 30 | Semester End Evaluation: | 70 | Total Marks: | 100 |

Course outcomes: Upon successful completion of the course, the student will be able to

| CO | Statement | Skill | BTL | Units |
|-----|---|------------|-----|-----------|
| CO1 | Learn all the methods to analyze beams, columns, bars for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. | Understand | L2 | 1,2,3,4,5 |
| CO2 | Analyze bars and beams subjected to axial, torsion loads. | Analyze | L4 | 2 |
| CO3 | Analyze the beams of different cross sections for deflection, bending and shear stresses | Analyze | L4 | 3, 4 |
| CO4 | Design and analysis of pressure vessels and columns | Analyze | L4 | 5 |

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO 1 | 3 | 3 | 3 | | | | 2 | | | 1 | | 2 | 3 | 2 |
| CO 2 | 3 | 3 | 3 | | | | 2 | | | 1 | | 2 | 3 | 2 |
| CO 3 | 3 | 3 | 3 | | | | 2 | | | 1 | | 2 | 3 | 2 |
| CO 4 | 3 | 3 | 3 | | | | 2 | | | 1 | | 2 | 3 | 2 |

| Syllabus | | |
|-----------------|---|--------------------|
| UNIT | Contents | Mapped CO's |
| I | <p>SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains–Hooke’s law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson’s ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses-</p> <p>COMPLEX STRESSES: Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr’s circle.</p> | CO1 CO2 |
| II | <p>SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams –Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.</p> <p>TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.</p> | CO1 CO2 |
| III | <p>FLEXURAL STRESSES: Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections– Design of simple beam sections.</p> <p>SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, I and T sections.</p> | CO1 CO3 |
| IV | <p>DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay’s methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, UDL and UVL. Mohr’s theorem and Moment area method – application to simple cases.</p> | CO1 CO3 |
| V | <p>THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.</p> <p>COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler’s Formula, Rankine’s Formula.</p> | CO1 CO4 |

| Learning Resources |
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| <p>Text Book(s):</p> <ol style="list-style-type: none"> 1. GH Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961. 2. B.C. Punmia, Strength of materials, 10/e, Lakshmi publications Pvt.Ltd, New Delhi, 2018. |

References:

3. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
4. U.C.Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
5. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
6. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, 4/e, Longman Publications, 1990.
7. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_ce18/preview.
- https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6.
- https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s
- <https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204>
- <https://www.coursera.org/learn/mechanics-1>
- <https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior>
- <https://archive.nptel.ac.in/courses/112/107/112107146/>