MECHANICS OF SOLIDS

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	PSO1	PSO2
CO 1	3	2	3	2	2						2	3	2
CO 2	3	3	2	2	2						2	3	2
CO 3	3	3	3	2	2						2	3	2
CO 4	3	3	3	2	2						2	3	2

Syllabus		
UNIT	**Contents**	**Mapped CO's**
I	**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- **COMPLEX STRESSES**: Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle.	**CO1 CO2**
II	**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. **TORSION**: Introduction-Derivation- Torsion of Circular shafts- Pure Shear- Transmission of power by circular shafts, Shafts in series, Shafts in parallel.	**CO1 CO2**
III	**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. **SHEAR STRESSES**: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, I and T sections.	**CO1 CO3**
IV	**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.	**CO1 CO3**
V	**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. **COLUMNS**: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.	**CO1 CO4**

Learning Resources
Text Book(s): 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, LongmanPulications, 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/**