16AG206 STRENGTH OF MATERIALS

Hours Per Week :

L	T	P	C
2	-	2	3

Total Hours :

L	T	P
30	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
5	40	5	8	5	-

Course Description and Objectives:

This course deals with concepts of mechanics of deformable solids including static equilibrium, geometry of deformation and behaviour of materials. The objective of this course is to enable the students to have an exposure to the systematic methods of solving engineering problems in solid mechanics. In addition, it also provides the basic mechanical principles underlying modern approaches for design of various types of structural members subject to axial, torsion, bending, transverse shear, and combined loading.

Course Outcomes:

The student will be able to:

- understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous and isotropic materials.
- establish relationship between shear load and shear force.
- derive flexural formula for simple bending.
- identify the variation in shear stress-shear strain distribution for various cross sections.
- calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.
- determine the deflections and rotations produced by the three fundamental types of loads: axial, torsional, and flexural.

SKILLS:

- ✓ *Measure tensile and compressive strength of materials using Universal Testing Machine.*
- ✓ *Measure shear strength of materials.*
- ✓ *Analyze deflections produced by axial, torsional and flexural loads.*

ACTIVITIES:

- *Measurement of tensile, compressive and shear strength of materials.*
- *Design of cantilever beam.*
- *Design of simply supported and overhanging beams.*

UNIT - 1 **L-5**

SIMPLE STRESSES AND STRAINS : Types of Stresses and Strains, Hooke's law, Stress strain diagram for ductile and Brittle materials, Salient points, Elastic constants and relations, Strain energy; Simple and compound bars, Thermal stresses, Stress on an inclined plane, Principle stresses – Mohr circle, Strain Energy-Resilience, Gradual, Sudden, Impact and Shock loadings.

UNIT - 2 **L-6**

SHEAR FORCE AND BENDING MOMENT : Types of loads and beams, Relation between shear load, Shear force and bending moment, Shear force and bending moment diagrams, Cantilevers – Simply supported beams and overhanging beams subjected to point loads, UDL and uniformly varying loads-Point of contra flexure.

DEFLECTION OF BEAMS: Introduction, Deflection equation for elastic curve of a beam, Deflection, Slope for cantilever beam and simply supported beams – point loads, UDL and uniformly varying loads, Double integration method, Macaulay's method, Area moment methods.

UNIT - 3 **L-6**

FLEXURE AND SHEAR STRESSES : Theory of simple bending, Assumptions, Flexural formula, Bending stresses in beams for various cross sections, Shear stresses in beams, Assumptions and derivation for variation of shear stress, Shear stress distribution for various cross-sections.

UNIT - 4 **L-6**

TORSION : Introduction, Torsion equation, Shear stress distribution for circular solid and hollow shafts, Stepped shafts, Shafts fixed at both the ends.

UNIT - 5 **L-7**

THIN CYLINDRICAL SHELLS : Introduction, Hoop and longitudinal stresses, Strains-Thin spherical shell - stresses; Columns and Struts- Introduction, Euler's Formula for critical load of columns for different end conditions, Limitations of Euler's theory, Rankine's formula, Simple Numerical.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS. **Total hours: 30**

1. Direct tension test.
2. Bending test on
   a) Simply supported beam b) Cantilever beam
3. Torsion test.
4. Hardness test
   a) Brinell hardness test b) Rockwell hardness test
5. Test on springs.
6. Compression test on cube.
7. Impact test.

TEXT BOOKS:

1. L. N. Srinath, "Advanced Mechanics of Solids", 3rd edition, Tata McGraw-Hill, 2010.
2. S. Singh, "Strength of Materials", 2nd edition, Khanna Publications, 2001.

REFERENCE BOOKS:

1. Bhavikatti, "Strength of Materials", 3rd edition, New Age International Publishers, 1998.
2. S. Timoshenko, "Strength of Materials", 3rd edition, D. Van Nostrand Company, 2004.
3. P. P. Egor, "Engineering Mechanics of Solids", 2nd edition, Prentice Hall of India, 1999.

WEB LINK:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=9