

## 22ME202 STRENGTH OF MATERIALS

Hours Per Week :

| L | T | P | C |
|---|---|---|---|
| 2 | 2 | 2 | 4 |

**PREREQUISITE KNOWLEDGE:** Fundamentals of Physics, Mechanics and Mathematics.

### COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the fundamental concepts of mechanics of deformable solids, stress analysis and deflections. The objective of this course is to determine the effect of forces and moments on engineering structures like beams, shafts subjected to various loads.

### MODULE-1

#### UNIT-1

6L+6T+6P=18 Hours

**Simple Stresses and Strains:** Classification of Stresses and Strains, Elastic Constants, Thermal Stresses, Principal stresses. Beams, supports and their reactions, Shear force and bending moment at a section

#### UNIT-2

10L+10T+10P=30 Hours

**Stress Analysis, SFD and BMD:** Stress-strain diagrams in tension, True vs Engineering stress-strain, Stresses on simple bars, stepped bars, compound bars due to forces applied and temperature change, Stresses on inclined planes, Principal stress, Mohr's circle, Shear force and bending moment diagrams.

#### PRACTICES:

- To study the behavior of beams subjected to bending loads.
- Stress-strain curves for engineering materials.
- To determine the Modulus of elasticity of a material subjected to tension.
- To determine the hardness of a material.
- Plot bending and shear stress distribution for different cross sections.
- To determine the impact strength of material.

### MODULE-2

#### UNIT-1

6L+6T+6P=18 Hours

**Bending and Torsion:** Theory of simple bending, Flexure formula, Bending and shear stresses distribution in various beam sections, Deflection of elastic beams. Torsional shear stresses in shafts, power transmission capacity of shafts.

#### UNIT-2

10L+10T+10P=30 Hours

**Stresses in Machine Member:** Application of area moment of inertia in the estimation of stresses in beams, Determination of maximum slope and deflection of beams. Shear stresses in shafts due to twisting moment, material saving in the design of hollow and solid shafts for same strength and rigidity.

#### PRACTICES:

- To estimate the bending stress of beams subjected to point loads.
- To estimate the deflection of beams subjected to transverse loads.
- To determine the Modulus of rigidity of a material subjected to torsion.
- To estimate the torsional shear stress and angle of twist of shafts subjected to twisting moment.
- Deflection of beams for various loading and boundary conditions.
- Analyze thermal stresses for statically determinate and indeterminate structures.

Source : <https://photostockeditor.com/free-images/chain-break>

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

| CO No. | Course Outcomes                                                                                              | Blooms Level | Module No. | Mapping with POs |
|--------|--------------------------------------------------------------------------------------------------------------|--------------|------------|------------------|
| 1      | Determine the stress, strain due to external force, temperature change.                                      | Apply        | 1          | 1, 2             |
| 2      | Plot shear force and bending moment diagrams for different beams and loading.                                | Apply        | 1          | 1, 2             |
| 3      | Estimate the bending stresses, shear stresses for beam sections subjected to different boundary and loading. | Analyze      | 2          | 1, 2             |
| 4      | Calculate torsional shear stress, modulus of rigidity of shaft materials subjected to twisting moment.       | Evaluate     | 2          | 1, 2             |

**TEXT BOOKS:**

1. Timoshenko S. P. "Elements of Strength of Materials", East-West Press, 5th Edition, 2021
2. Ferdinand Beer, "Mechanics of Materials", McGraw Hill Education, 8th Edition, 2020

**REFERENCE BOOKS:**

1. Robert L. Mott and Joseph A. "Applied Strength of Materials", CRC Press, 6th Edition, 2017.
2. S S. Rattan, "Strength of Materials", Mc-Graw Hill, 3rd Edition, 2016.
3. R.S. Khurmi & N. Khurmi, "Strength of Materials" S.Chand Publication, Revised Edition, 2016.