

# AMSF-03 STRENGTH OF MATERIALS

## UNIT-1 INTRODUCTION

- 1.1 Interdisciplinary
- 1.2 Brief Historical Review
- 1.3 Organization of the book

## UNIT-2 SIMPLE STRESSES AND STRAINS

- 2.1 General Meaning of stress, Unit of stress, Simple Stresses, Normal stress, Shear stress Strain, Stress Strain Relation,
- 2.2 Behaviour in Tensions, Behaviour of Materials under compression,
- 2.3 Nominal stress and true stress
- 2.4 Behaviour of Materials under Repeated Loadings
- 2.5 Factor of Safety
- 2.6 Hooke's Law
- 2.7 Extension / Shortening of a bar, Bars with cross-sections varying in steps, Bars with continuously varying cross-sections,
- 2.8 Bars subjected to varying loads, Indeterminate structural problems, Compound Bars
- 2.9 Temperature stresses, Simple Shear
- 2.10 Poisson's Ratio, Volumetric Strain
- 2.11 Elastic Constants, Relationship between Modulus of Elasticity and Modulus of Rigidity, Relationship between Modulus of Elasticity and Bulk Modulus
- 2.12 Strain Energy due to Direct Stresses and Impact Loads, Strain Energy due to shear Stresses

## UNIT-3 SHEAR FORCE AND BENDING MOMENT DIAGRAMS IN STATICALLY DETERMINATE BEAMS

- 1.1 Shear Force and Bending Moment
- 1.2 Sign Convention
- 1.3 Relationship between load Intensity, Shear Force and Bending Moment
- 1.4 Shear Force and Bending Moment Diagrams, SFD and BMD for Standard Cases
- 1.5 SFD and BMD for beams subjected to various loads, Short Cut procedure

## UNIT-4 STRESSES IN BEAMS

- 4.1 Theory of Simple Bending, Moment carrying capacity of a section, Composite beams/ flitched beams, Beams of Uniform strength
- 4.2 Leaf Springs
- 4.3 Shearing Stresses in Beams, Shear Stresses across a few Standard Sections
- 4.4 Shear Stresses in Built Up Sections, Limitation of Theory Developed

## UNIT-5 DEFLECTIONS OF BEAMS BY DOUBLE INTEGRATION METHOD

- 5.1 Differential Equation for Deflection, Other Useful Equations,
- 5.2 Double Integration Method, A few General Cases, Macaulay's Method

## **UNIT-6 TORSION**

- 6.1 Introduction, Pure Torsion, Assumptions in the Theory of pure Torsion,
- 6.2 Derivation of Torsional Equations
- 6.3 Polar Modulus, Power Transmitted
- 6.4 Torsional rigidity/ Stiffness of Shafts, Stepped shafts and Composite Shafts
- 6.5 Shear Keys, Coupling
- 6.6 Torsion of a Tapering Shaft
- 6.7 Strain Energy in Torsion
- 6.8 Closed Coiled Helical Springs
- 6.9 Torsion of shafts of Non-circular sections

## **UNIT-7 COMPOUND STRESSES**

- 7.1 Stresses on an Inclined Plane
- 7.2 Mohr's Circle of Stress
- 7.3 Compound Stresses in Beams
- 7.4 Shafts Subjected to combined Bending and Torsion
- 7.5 Shafts subjected to Combined Action of Bending, Torsion and Axial Thrust

## **UNIT-8 THIN AND THICK CYLINDERS AND SPHERES**

- 8.1 Stresses in Thin Cylinders
- 8.2 Changes in Dimensions of Cylinder
- 8.3 Riveted Cylinders, Wire Wound Cylinders
- 8.4 Thin Spherical shells, Thick cylinders
- 8.5 Compound Cylinders, Shrinkage Allowance, Thick spherical shells

## **UNIT-9 COLUMNS AND STRUTS**

- 9.1 Short columns subjected to Axial Loads
- 9.2 Eccentrically loaded masonry columns
- 9.3 Euler's Theory for Axially Loaded Elastic long columns
- 9.4 Effective Length, Limitations of Euler's theory
- 9.5 Rankine's Formula, Formula used by Indian Standard Code

## **UNIT-10 THEORIES OF FAILURES**

- 10.1 Maximum Principal Stress Theory, Maximum Shear Stress Theory
- 10.2 Maximum Strain Theory, Maximum Strain Energy Theory
- 10.3 Maximum Distortion Energy Theory

### **Reference Books:**

1. A Textbook of Strength of Materials Book by R.K. Bansal
2. Mechanics of Materials Book by James M. Gere