THEORY AND ANALYSIS OF STRUCTURE VOLUME I

CHAPTER 1 Structural Engineering

1.1 Stress 1.2 Design

CHAPTER 2 Types of Stresses

- 2.1 Stress2.2 Types of Stress2.3 Direct Stress2.4 Shear Stress2.5 Torsional Stress
- 2.6 Bending Stress

CHAPTER 3 Simple Stresses and Strains

3.1 Elasticity 3.2 Stress and Strain 3.3 Hook's Law 3.4 The Tensile Test Diagram 3.5 Factor of Safety and Working Stress 3.6 Stress in Composite Bars 3.7 Thermal or Temperature Stresses 3.8 Thermal Stresses in Composite Bars 3.9 Lateral Strains-Poisson's Ratio 3.10 Volumetric Strain 3.11 Bulk Modulus 3.12 Strain Energy-Resilience 3.13 Work Done in Elastic Straining 3.14 Stresses in Thin Walled Cylinders 3.15 Increase in Volume of Cylinder 3.16 Stresses in Thin Spherical Shells 3.17 Increase in Volume of a Sphere 3.18 Cylindrical Shell with Hemispherical Ends 3.19 Thick Cylinderical Shells 3.20 Combined Cylinders Problems

CHAPTER 4 Triangulated Framed Structures

- 4.1 Introductory
 4.2 Evolution of Frame
 4.3 Perfect and Imperfect Frames
 4.4 Forces on a Frame
 4.5 End Supports and Reactions
 4.6 Load Systems on a Truss
 4.7 A few Definitions
 4.8 Algebraic Method
 4.10 Algebraic Method
- 4.11 Graphical Method (Bow's Notation)

4.12 Analysis of a Roof Truss4.13 The Method of Sections4.14 Compound Trusses4.15 Critical Form of Trusses4.16 Complex Trusses4.17 Some Special Bridge TrussesProblems

CHAPTER 5 Transverse and Torsional Shear

5.1 Introductory
5.2 Complementary Shear Stresses
5.3 Simple or Pure Shear Stress
5.4 Measurement of Shear Stress
5.5 Shearing Strain
5.6 Relations Between the Elastic Constants
5.7 Torsional Shear Stress – A solid Circular Shaft
5.8 Torsion of a Hollow Circular Shaft
5.9 Rotating Shafts – Transmission of Power
5.10 Shaft Couplings
5.11 Close Coiled Helical Springs
Problems

CHAPTER 6 Bending Moments and Shearing Forces

6.1 Introductory 6.2 Beam 6.3 Types of Supports and End Reactions 6.4 Types of Loading 6.5 Equilibrium of Loads on a Beam 6.6 Shearing Force and Bending Moment 6.7 Shear Force and Bending Moment Diagrams 6.8 Sign Conventions 6.9 S.F. and B.M. Diagrams – Simple Load Systems 6.10 Beams with End Couples 6.11 Beam with Variable Loading 6.12 Relations Between Load, Shearing Force and Bending Moment 6.13 Graphical Methods 6.14 Oblique Loads 6.15 Moving Loads 6.16 Influence Lines Problems

CHAPTER 7 Stresses in Beams

7.1 Introductory

7.2 Forces on Beam Section

7.3 Bending Stresses-Theory of Simple Bending

7.4 Equilibrium of Forces on the Beam Section-The Flexure Formula

7.5 Beams of Material Equally Strong in Compression and Tension

7.6 Beams of Materials having Different Strengths in Compression and Tension

- 7.7 Beams of Uniform Strength
- 7.8 Beams of Two Materials

7.9 Shearing Stresses7.10 Distribution of Shearing Stresses7.11 Strengthening of Beams7.12 Bending of Beam having two Planes of SymmetryProblems

CHAPTER 8 Axial and Bending Stresses Combined

8.1 Introductory8.2 Non Axial Forces8.3 Eccentric Loading of a Short Strut8.4 Walls under Water PressureProblems

CHAPTER 9 Deflections – Fixed and Continuous Beams

9.1 Introductory
9.2 Curvature of the Beam Axis
9.3 Deflection of the Beam Axis
9.4 Non Symmetrical Loading
9.5 Area Moment Method
9.6 Propped Cantilevers and Beams
9.7 Fixed and Continuous Beams
9.8 Advantages & Disadvantages of Continuous Beams
9.9 Built-up Carriage Spring Problems

CHAPTER 10 Columns and Struts

10.1 Introductory
10.2 Axially Loaded Long Columns (Euler's Theory)
10.3 Eccentric Loading of Columns
10.4 Extent of Application of the Euler Formula
10.5 End Supports in Columns
10.6 Empirical Formulae for the Design of Compression Members
10.7 Built up Struts
10.8 Columns with Initial Curvature
10.9 Struts and Ties with Lateral Loads
10.10 Perry-Robertson Formula
10.11 Indian Standard Code
Problems

CHAPTER 11 Principal Stresses

11.1 Introductory

- 11.2 General Two-Dimensional Stress System
- 11.3 The Basic Problem in Stress Analysis
- 11.4 Stresses on a Plane
- 11.5 Maximum and Minimum Normal Stresses-The Principal Stresses
- 11.6 Maximum and Minimum Shear Stresses
- 11.7 Method of Superposition
- 11.8 The Mohr's Circle
- 11.9 Stress Relations from Mohr's Circle

11.10 Mohr's Circle for the General Case of Plane Stresses11.11 Further Stress Relations from Mohr's Circle11.12 Resultant Stresses on Oblique Planes11.13 Principal Stresses in Shafts Subjected to Torsion11.14 A Few Practical ApplicationsProblems

CHAPTER 12 Masonry Structures and Earth Pressure

12.1 Introductory
12.2 Walls
12.3 Ordinary Walls
12.4 Water Retaining Walls
12.5 Earth Retaining Walls
12.6 Rankine's Theory of Earth Pressure
12.7 Wedge Theory of Erath Pressure
12.8 Design of a Retaining Wall
12.9 Pressure on Foundation-Minimum Depth
12.10 The Masonry Arch
Problems

CHAPTER 13 Riveted Joints

13.1 Introductory
13.2 Uncertainties
13.3 Transmission of Stress in Riveted Joints
13.4 A Few Terms and Definitions
13.5 Methods of Failure of a Joint
13.6 Strength of a Joint
13.7 Design of Riveted Joints
13.8 Eccentric Riveted Connections
Problems

CHAPTER 14 Some Statically Indeterminate Probems

CHAPTER 15 Tests on Materials

15.1 Introductory
15.2 The Buckon Machine
15.3 Measurement of Deformation (Strain)
15.4 Effect of Shape of Specimen on Strength
15.5 Torsion Testing
15.6 Hardness Testing
15.7 Impact Testing
15.8 The Fatigue of Metals