



MECHANICS OF STRUCTURES VOL. I

[STRENGTH OF MATERIALS]

By
Dr. H. J. Shah, S. B. Junnarkar

Edition : 32nd Edition : 2016
ISBN : 9789385039270
Binding : Paperback
Pages : 988 + 20 = 1008
Size (mm) : 235 × 42 × 170
Weight : 1255 g

Best
Seller



₹ 425.00 BUY

ABOUT THE BOOK

This standard text-book along with its companion Vol. II is designed to cover the complete syllabi of the subjects of *Strength of Materials and Theory and Analysis of Structures*.

The outline of the book is:

- Chapters 1 to 8 consist the study of Stresses and Strains
- Chapters 9 and 24 discuss the Testing of Materials
- Chapters 10 and 11 Shear Forces and Bending Moments
- Chapters 12 and 13 Properties of Lines and Areas
- Chapters 14 and 15 Stresses in Beams
- Chapters 16 and 17 Deflections
- Chapters 18 and 19 Analysis of Fixed and Continuous Beams
- Chapters 20 and 21 Composite and Reinforced Concrete Beams
- Chapters 22 Direct and Bending Stresses and Chapter 23 Torsion
- Chapters 25 Columns and Struts of Uniform Section
- Chapters 26 Cylindrical and Spherical Shells
- Chapters 27 and 28 Riveted, Bolted and Welded Joints
- Chapters 29, 30 and 31 consist of special topics such as Shear Centre, Unsymmetrical Bending and Bending Stresses in Curved Bars.

The book within its 971 + 20 pages, it now comprise the following:

- * 900 Neatly drawn figures
- * 600 Fully illustrated solved examples
- * 715 Unsolved examples with answers at the end of chapters
- * 33 Useful tables

It is hoped that this edition should prove extremely useful to students of Engineering reading for Degree Examinations of all the Universities of India, Diploma Examinations conducted by various Boards of Technical Education, Certificate Courses, as well as for the U.P.S.C., G.A.T.E., A.M.I.E., I.E.S and other similar competitive and professional examinations. It should also prove of great interest and practical use to the practising engineers.

CONTENT

- 1: SIMPLE STRESS
 - 2: SIMPLE STRAIN
 - 3: STATICALLY INDETERMINATE MEMBERS
 - 4: THERMAL STRESSES AND STRAINS
 - 5: STRESSES ON INCLINED PLANES
 - 6: COMBINED STRESSES
 - 7: MOHR'S CIRCLE METHOD
 - 8: IMPACT OR SHOCK LOADING: STRAIN-ENERGY
 - 9: TESTING OF MATERIALS – I
 - 10: SHEAR FORCES AND BENDING MOMENTS – I
 - 11: SHEAR FORCES AND BENDING MOMENTS – II
 - 12: CENTROIDS OF LINES AND AREAS
 - 13: AREA MOMENTS OF INERTIA
 - 14: BENDING STRESSES IN BEAMS
 - 15: SHEAR STRESSES IN BEAMS
 - 16: DEFLECTIONS I
 - 17: DEFLECTIONS II
 - 18: FIXED BEAMS
 - 19: CONTINUOUS BEAMS
 - 20: COMPOSITE BEAMS
 - 21: REINFORCED CONCRETE BEAMS
 - 22: DIRECT AND BENDING STRESSES
 - 23: SHAFTS AND SPRINGS IN TORSION
 - 24: TESTING OF MATERIALS – II
 - 25: COLUMNS AND STRUTS OF UNIFORM SECTION
 - 26: RADIAL PRESSURE
– CYLINDRICAL AND SPHERICAL SHELLS
 - 27: RIVETED AND BOLTED JOINTS
 - 28: WELDED JOINTS
 - 29: SHEAR CENTRE
 - 30: UNSYMMETRICAL BENDING
 - 31: BENDING STRESSES IN CURVED BARS
- INDEX

Catalogue Checklist

MECHANICS OF STRUCTURES VOL. I
DETAILED CONTENTS

Chapter 1 SIMPLE STRESS

- 1-1. Introduction to Mechanics of deformable bodies
 - 1-2. Loading a bar
 - 1-3. Principle of superposition
 - 1-4. Classification of loaded bar
 - 1-5. Gradual, sudden, impact and shock loading
 - 1-6. Tension and compression
 - 1-7. Resistance of an axially loaded bar
 - 1-8. Concept of a stress
 - 1-9. Normal stresses
 - 1-10. Simple stress
 - 1-11. Design of an axially loaded member
 - 1-12. Non-prismatic bars
 - 1-13. Axial force diagram
 - 1-14. Rotating rings
 - 1-15. Shear
 - 1-16. Shear stress
 - 1-17. Pure shear
 - 1-18. Bearing stress
- Examples I

Chapter 2 SIMPLE STRAIN

- 2-1. Introduction
 - 2-2. Linear strain
 - 2-3. Shear strain
 - 2-4. Elasticity
 - 2-5. Hooke's law
 - 2-6. Axial and shear deformations
 - 2-7. Bars of varying section
 - 2-8. Bars of uniformly varying cross-section
 - 2-9. A bar subjected to self-weight
 - 2-10. Bar of uniform strength
 - 2-11. Bars subjected to uniformly varying loads
 - 2-12. Pin-jointed determinate frames
 - 2-13. Lateral strain: Poisson's ratio
 - 2-14. Biaxial and triaxial deformations
- Examples II

Chapter 3 STATICALLY INDETERMINATE MEMBERS

- 3-1. Introduction
 - 3-2. Composite bars
 - 3-3. Equivalent modulus of a composite bar
 - 3-4. Pin-jointed bars
 - 3-5. Stresses due to lack of fit
- Examples III

Chapter 4 THERMAL STRESSES AND STRAINS

- 4-1. Introduction
 - 4-2. General
 - 4-3. Coefficient of linear expansion
 - 4-4. Stresses due to changes of temperature
 - 4-5. Compound bar
 - 4-6. Composite bar
 - 4-7. Bars of uniformly varying cross-section
 - 4-8. Shrinking-on
- Examples IV

Chapter 5 STRESSES ON INCLINED PLANES

- 5-1. Introduction
 - 5-2. Stresses on inclined plane of a bar under tension or compression
 - 5-3. State of pure shear: Stresses on inclined planes
 - 5-4. Linear strain of the diagonal BD
 - 5-5. Relation between the Moduli of Elasticity and Rigidity for a given material
 - 5-6. Bulk Modulus
 - 5-7. Relation between three elastic constants
- Examples V

Chapter 6 COMBINED STRESSES

- 6-1. Introduction
 - 6-2. Stress components
 - 6-3. Element subjected to general plane stress system
 - 6-4. Principal planes and principal stresses
 - 6-5. Planes carrying maximum shear stress
 - 6-6. Element subjected to principal stresses
- Examples VI

Chapter 7 MOHR'S CIRCLE METHOD

- 7-1. Mohr's circle method
- Sign conventions
Rules and construction
Examples VII

Chapter 8 IMPACT OR SHOCK LOADING: STRAIN-ENERGY

- 8-1. Introductory
 - Axial Loading
 - 8-2. Strain-Energy: Resistance-deformation diagram
 - 8-3. Gradual, sudden, impact and shock loading
 - 8-4. Limitations
 - Shear Loading
 - 8-5. Shear Resilience
 - 8-6. Strain-energy in terms of principal stresses
 - 8-7. Relation between the elastic moduli
 - 8-8. Criteria for design
- Examples VIII

Chapter 9 TESTING OF MATERIALS – I

- 9-1. Introduction
 - 9-2. Metals and alloys
 - 9-3. Testing machines
 - Tension Tests
 - 9-4. The complete tensile test
 - 9-5. Stress-strain diagram
 - 9-6. Physical properties of materials
 - 9-7. Modulus of elasticity
 - 9-8. Yield point by the offset method: Proof stress
 - 9-9. Secant modulus
 - 9-10. Specific modulus of elasticity
 - 9-11. Resilience
 - 9-12. Toughness
 - Compression tests
 - 9-13. The compression test
 - 9-14. Compression tests on wood and concrete
 - 9-15. Permissible stress: Factor of safety
 - Stress concentration
 - 9-16. Stress concentration
 - 9-17. Stress concentration factor
 - 9-18. Importance of stress concentration under different loads
 - 9-19. Elastoplastic materials: Limit design
- Examples IX

Chapter 10 SHEAR FORCES AND BENDING MOMENTS – I

- 10-1. Introductory
 - 10-2. Types of beams
 - 10-3. Actions on the cross-section of a beam
 - 10-4. Sign conventions
 - 10-5. Shear Force (S.F.) and Bending Moment (B.M.) diagrams
 - 10-6. Cantilevers
 - 10-7. Simply supported beams
 - 10-8. Relation between the S.F. and the B.M. at a cross-section of a beam
 - 10-9. Overhanging beams
- Examples X

MECHANICS OF STRUCTURES VOL. I
DETAILED CONTENTS

Chapter 11 SHEAR FORCES AND BENDING MOMENTS – II

- 11-1. Introduction
- 11-2. S.F. and B.M. diagrams for beams with variable loading
- 11-3. Beams with end couples
- 11-4. Beams with an intermediate couple
- 11-5. Supports offering pressures
- 11-6. Cantilever structures
- 11-7. Principle of superposition
- 11-8. Moment and loading diagrams drawn from shear diagrams
- 11-9. Beams subjected to inclined loads
- 11-10. Inclined beams
- 11-11. Graphical methods
Examples XI

Chapter 12 CENTROIDS OF LINES AND AREAS

- 12-1. Introduction
Centroids
- 12-2. First moment of an element of line and area
- 12-3. First moment of a line segment and a finite area
- 12-4. Centroids of lines and areas
- 12-5. Centroids of symmetrical lines and areas
- 12-6. Centroids by integration
- 12-7. Summary of centroids of common figures
- 12-8. Centroids of composite areas
Examples XII

Chapter 13 AREA MOMENTS OF INERTIA

- 13-1. Introduction
- 13-2. Definitions
- 13-3. Radius of gyration
- 13-4. Parallel axis theorem
- 13-5. Moment of inertia by integration
- 13-6. Moment of inertia of composite areas
- 13-7. Graphical method for first and second moments of a plane section about an axis in its plane
- 13-8. Product of inertia
- 13-9. Moment of inertia with respect to inclined axes: Rotation of axes
- 13-10. Principal moments of inertia: Principal axes
- 13-11. Mohr's circle for moments of inertia
- 13-12. The Mohr Land circle of inertia
- 13-13. Momental ellipse
Examples XIII

Chapter 14 BENDING STRESSES IN BEAMS

- 14-1. Simple bending
- 14-2. Theory of simple bending
- 14-3. Modulus of section or section modulus
- 14-4. Application of bending equation
- 14-5. Modulus of rupture
- 14-6. Beams of rectangular section
- 14-7. Strength of sections
- 14-8. Economic sections
- 14-9. Unsymmetrical and built-up sections
- 14-10. The Modulus figure
- 14-11. Beam of uniform strength
- 14-12. Strain energy in flexure
- 14-13. Laminated springs
Examples XIV

Chapter 15 SHEAR STRESSES IN BEAMS

- 15-1. Resistance to shear force: shear stresses
- 15-2. Shear flow
- 15-3. Shear stresses in beams of rectangular and circular sections
- 15-4. Shear stresses in beams of I-section
- 15-5. Assumptions and limitations of the shear stresses formula
- 15-6. Shear stresses in built-up sections
- 15-7. Beam of square section with one diagonal horizontal
- 15-8. Design for flexure and shear
- 15-9. Principal stresses and Principal planes at a point in a beam section

- 15-10. Curves of principal stresses
- 15-11. Principal stresses in an I-section
- 15-12. Strain-energy due to shear in a beam
Examples XV

Chapter 16 DEFLECTIONS I

- 16-1. Introductory
- 16-2. Use of deflection computations
- 16-3. Bending into a circular arc
- 16-4. Relation between slope deflection and radius of curvature
- 16-5. Axes of reference
- 16-6. Limitations of the equation of elastic line
- 16-7. Computations from basic equation
- 16-8. Using the principle of superposition
- 16-9. Cantilevers
- 16-10. Propped cantilevers
- 16-11. Simply supported beams
- 16-12. Relation between maximum stress and maximum deflection
- 16-13. Propped beams — Rigid and elastic props
- 16-14. Simply supported beam with an eccentric load W
- 16-15. Non-prismatic beams
- 16-16. Macaulay's method
- 16-17. Variable loading on a beam of uniform section
- 16-18. Closure
Examples XVI

Chapter 17 DEFLECTIONS II

- 17-1. Moment area method
- 17-2. Method of elastic weights
- 17-3. Conjugate beam method
- 17-4. Impact loading on beams
- 17-5. Deflection by strain energy
- 17-6. Beams of variable section
- 17-7. Graphical methods
Examples XVII

Chapter 18 FIXED BEAMS

- 18-1. Introductory
Indeterminate Structures
- 18-2. Determinateness of the structure
- 18-3. Use of indeterminate structures
- 18-4. Methods of analysis
Fixed Beams
- 18-5. Fixed, built in, restrained or encastré beams
- 18-6. Method of superposition
- 18-7. Double integration method
- 18-8. Solution by moment area method
- 18-9. Sinking of support
- 18-10. Rotation of support
- 18-11. Review of deflection methods
- 18-12. Degree of restraint at supports for maximum bending moment to be as small as possible
- 18-13. Beams with related deflections
Examples XVIII

Chapter 19 CONTINUOUS BEAMS

- 19-1. Continuous beams
- 19-2. The three moment theorem
- 19-3. Support settlement
Examples XIX

Chapter 20 COMPOSITE BEAMS

- 20-1. Introductory
- 20-2. Flitched beams
- 20-3. Equivalent section: Transformed area method
- 20-4. Deflection of composite beams
Examples XX

MECHANICS OF STRUCTURES VOL. I
DETAILED CONTENTS

Chapter 21 REINFORCED CONCRETE BEAMS

- 21-1. Reinforced concrete
- 21-2. Compressive strength of concrete
- 21-3. Steel as reinforcement
- 21-4. Types of reinforcement
- 21-5. Mild steel bars
- 21-6. High yield strength deformed (HYSD) bars
- 21-7. Design of a beam
- 21-8. Classification of beams
- 21-9. Balanced, Under-reinforced and Over-reinforced design
- 21-10. Permissible stresses
- 21-11. Assumptions for flexure design
Singly Reinforced Beams
- 21-12. Derivation of formulae for balanced design
- 21-13. Transformed area method
- 21-14. Types of problems
Examples XXI

Chapter 22 DIRECT AND BENDING STRESSES

- 22-1. Introduction
- 22-2. Combined axial and flexural load
- 22-3. Biaxial loading
- 22-4. Eccentric loading
- 22-5. Limit of eccentricity
- 22-6. Double eccentricity
- 22-7. Wind pressure on walls and chimney shafts
- 22-8. Coefficient of wind-resistance
- 22-9. Water and earth pressure on walls
Examples XXII

Chapter 23 SHAFTS AND SPRINGS IN TORSION

- 23-1. Introduction
- 23-2. Assumptions
- 23-3. Derivation of torsion formulae
- 23-4. Power transmitted: design of shafts
- 23-5. Torque diagrams
- 23-6. Stepped shaft
- 23-7. Composite shafts and tapered shaft
- 23-8. Keys and couplings
- 23-9. Combined bending and torsion
- 23-10. Combined bending and torsion and axial thrust
- 23-11. Torsion resilience of shafts
- 23-12. Shafts of non-circular sections subjected to torsion
- 23-13. Closely coiled helical springs: Axial loading
- 23-14. Closely coiled helical springs: Axial moment
- 23-15. Open coiled helical springs
Examples XXIII

Chapter 24 TESTING OF MATERIALS – II

- 24-1. Flexure tests
- 24-2. Important flexure tests
- 24-3. Shear tests
- 24-4. Hardness
- 24-5. Brinell hardness test
- 24-6. Rockwell hardness test
- 24-7. Impact tests
- 24-8. Fatigue
- 24-9. Stress spectrum
- 24-10. Fatigue tests
- 24-11. The S-N curve
- 24-12. Endurance limit or fatigue limit
- 24-13. Fatigue failure
Examples XXIV

Chapter 25 COLUMNS AND STRUTS OF UNIFORM SECTION

- 25-1. Axial loading
- 25-2. Very long columns — Euler's formula
- 25-3. Limitations of Euler's formulae
- 25-4. Intermediate columns
- 25-5. Rankine's formula

- 25-6. Design of struts and columns
- 25-7. Other empirical formulae
- 25-8. Long columns under eccentric loading
- 25-9. Prof. Perry's formula
- 25-10. Initial curvature on long column: Axial loading
- 25-11. Perry-Robertson formula
- 25-12. B.I.S. formula
- 25-13. Struts with transverse loading
Examples XXV

Chapter 26 RADIAL PRESSURE – CYLINDRICAL AND SPHERICAL SHELLS

- 26-1. Thin seamless cylindrical shells
- 26-2. Riveted boiler shells
- 26-3. Thin spherical shell
- 26-4. Wire-bound thin pipes or shells
- 26-5. Thick cylinders: Lami's formulae
- 26-6. Design of thick cylindrical shells
- 26-7. Compound cylinders
- 26-8. Shrink-fit allowance: Initial difference of radii at junction
- 26-9. Thick spherical shells
Examples XXVI

Chapter 27 RIVETED AND BOLTED JOINTS

- 27-1. Introductory
- 27-2. Rivets and riveting
- 27-3. Bolts and bolting
- 27-4. Bearing and friction type connections
- 27-5. Types of riveted and bolted joints
- 27-6. Definitions
- 27-7. Possible ways of failure of bearing type connection
- 27-8. Strength of a bearing type connection
- 27-9. Fastener value
- 27-10. Design of a riveted/bolted joint
- 27-11. Riveted joints in boiler shells
- 27-12. Structural joints
- 27-13. Diamond fastening
- 27-14. Pitch of rivets in built-up girders
- 27-15. Eccentric loading on rivets
Examples XXVII

Chapter 28 WELDED JOINTS

- 28-1. Introductory
- 28-2. Forms of welded joints
- 28-3. Strength of a welded joint
- 28-4. Eccentric loading on welded joints
Examples XXVIII

Chapter 29 SHEAR CENTRE

- 29-1. Shear flow in thin-walled open sections
- 29-2. Shear centre
Examples XXIX

Chapter 30 UNSYMMETRICAL BENDING

- 30-1. Introductory
- 30-2. Unsymmetrical bending
- 30-3. Bending stress through product of inertia
- 30-4. The Z-polygon
Examples XXX

Chapter 31 BENDING STRESSES IN CURVED BARS

- 31-1. Pure bending of curved bars
- 31-2. Stresses in beams of large initial curvature
- 31-3. Rectangular cross-section
- 31-4. Trapezoidal cross-section
- 31-5. Inverted T-section
- 31-6. I-section
- 31-7. Circular cross-section
- 31-8. Crane hooks
- 31-9. Stresses in curved bars of small initial curvature
- 31-10. Piston rings
Examples XXXI

Index