

GLOBAL
EDITION



Mechanics of Materials

ELEVENTH EDITION
IN SI UNITS

R. C. Hibbeler



MECHANICS OF MATERIALS

ELEVENTH EDITION IN SI UNITS

Mechanics of Materials, eBook, SI Edition

Table of Contents

Cover

Half Title

Title Page

Copyright Page

To the Student

Preface

your work...

With the Power of Mastering Engineering for Mechanics of Materials

Pearsons Commitment to Diversity, Equity, and Inclusion

Credits

Contents

Chapter 1. Stress

Chapter Objectives

1.1 Introduction

1.2 Equilibrium of a Deformable Body

1.3 Stress

1.4 Average Normal Stress in an Axially Loaded Bar

1.5 Average Shear Stress

1.6 Allowable Stress Design

1.7 Limit State Design

Chapter Review

Review Problems

Table of Contents

Chapter 2. Strain

Chapter Objectives

2.1 Deformation

2.2 Strain

Chapter 3. Mechanical Properties of Materials

Chapter Objectives

3.1 The Tension and Compression Test

3.2 The StressStrain Diagram

3.3 StressStrain Behavior of Ductile and Brittle Materials

3.4 Strain Energy

3.5 Poissons Ratio

3.6 The Shear StressStrain Diagram

3.7 Failure of Materials Due to Creep and Fatigue

Chapter Review

Review Problems

Chapter 4. Axial Load

Chapter Objectives

4.1 Saint-Venants Principle

4.2 Elastic Displacement of an Axially Loaded Member

4.3 Principle of Superposition

4.4 Statically Indeterminate Axially Loaded Members

4.5 The Force Method of Analysis for Axially Loaded Members

4.6 Thermal Stress

4.7 Stress Concentrations

4.8 Inelastic Axial Deformation

4.9 Residual Stress

Chapter Review

Table of Contents

Review Problems

Chapter 5. Torsion

Chapter Objectives

5.1 Torsional Deformation of a Circular Shaft

5.2 The Torsion Formula

5.3 Power Transmission

5.4 Angle of Twist

5.5 Statically Indeterminate Torque-Loaded Members

5.6 Solid Noncircular Shafts

5.7 Thin-Walled Tubes Having Closed Cross Sections

5.8 Stress Concentration

5.9 Inelastic Torsion

5.10 Residual Stress

Chapter Review

Review Problems

Chapter 6. Bending

Chapter Objectives

6.1 Internal Loading as a Function of Position

6.2 Graphical Method for Constructing Shear and Moment Diagrams

6.3 Bending Deformation of a Straight Member

6.4 The Flexure Formula

6.5 Unsymmetric Bending

6.6 Composite Beams

6.7 Reinforced Concrete Beams

6.8 Curved Beams

6.9 Stress Concentrations

6.10 Inelastic Bending

Table of Contents

Chapter Review

Review Problems

Chapter 7. Transverse Shear

Chapter Objectives

7.1 Shear in Straight Members

7.2 The Shear Formula

7.3 Shear Flow in Built-Up Members

7.4 Shear Flow in Thin-Walled Members

7.5 Shear Center for Open Thin-Walled Members

Chapter Review

Review Problems

Chapter 8. Combined Loadings

Chapter Objectives

8.1 Thin-Walled Pressure Vessels

8.2 State of Stress Caused by Combined Loadings

Chapter Review

Review Problems

Chapter 9. Stress Transformation

Chapter Objectives

9.1 Plane Stress Transformation

9.2 General Equations of Plane Stress Transformation

9.3 Principal Stresses and Maximum In-Plane Shear Stress

9.4 Mohr's CirclePlane Stress

9.5 Absolute Maximum Shear Stress

Chapter Review

Review Problems

Chapter 10. Strain Transformation

Table of Contents

Chapter Objectives

10.1 Plane Strain

10.2 General Equations of Plane Strain Transformation

10.3 Mohr's CirclePlane Strain

10.4 Absolute Maximum Shear Strain

10.5 Strain Rosettes

10.6 Material Property Relationships

10.7 Theories of Failure

Chapter Review

Review Problems

Chapter 11. Design of Beams and Shafts

Chapter Objectives

11.1 Basis for Beam Design

11.2 Prismatic Beam Design

11.3 Fully Stressed Beams

11.4 Shaft Design

Chapter Review

Review Problems

Chapter 12. Deflection of Beams and Shafts

Chapter Objectives

12.1 The Elastic Curve

12.2 Slope and Displacement by Integration

12.3 Discontinuity Functions

12.4 Slope and Displacement by the Moment-Area Method

12.5 Method of Superposition

12.6 Statically Indeterminate Beams and Shafts

12.7 Statically Indeterminate Beams and ShaftsMethod of Integration

Table of Contents

12.8 Statically Indeterminate Beams and Shafts Moment-Area Method

12.9 Statically Indeterminate Beams and Shafts Method of Superposition

Chapter Review

Review Problems

Chapter 13. Buckling of Columns

Chapter Objectives

13.1 Critical Load

13.2 Ideal Column with Pin Supports

13.3 Columns Having Various Types of Supports

13.4 The Secant Formula

13.5 Inelastic Buckling

13.6 Design of Columns for Concentric Loading

13.7 Design of Columns for Eccentric Loading

Chapter Review

Review Problems

Chapter 14. Energy Methods

Chapter Objectives

14.1 External Work and Strain Energy

14.2 Elastic Strain Energy for Various Types of Loading

14.3 Conservation of Energy

14.4 Impact Loading

14.5 Principle of Virtual Work

14.6 Method of Virtual Forces Applied to Trusses

14.7 Method of Virtual Forces Applied to Beams

14.8 Castiglianos Theorem

14.9 Castiglianos Theorem Applied to Trusses

14.10 Castiglianos Theorem Applied to Beams

Table of Contents

Chapter Review

Review Problems

Appendices

Appendix A. Geometric Properties of an Area

Appendix B. Geometric Properties of Structural Shapes

Appendix C. Slopes and Deflections of Beams

Fundamental Problems Partial Solutions and Answers

Answers to Selected Problems

Index

Average Mechanical Properties of Typical Engineering Materials (SI Units)

Fundamental Equations of Mechanics of Materials

Geometric Properties of Area Elements