Contents

Part I Section-by-Section, Chapter-by-Chapter Summaries with Review Questions and Answers					
1	1 General Principles 3				
		Main Goals of This Chapter 3			
	1.1	Mechanics 3			
	1.2	Fundamental Concepts 3			
	1.3	Units of Measurement 5			
	1.4	The International System of Units 5			
	1.5	Numerical Calculations 6			
	1.6	General Procedure for Analysis 6			
		Helpful Tips and Suggestions 7			
		Review Questions 7			
2	2 Force Vectors 8				
		Main Goals of This Chapter 8			
	2.1	Scalars and Vectors 8			
	2.2	Vector Operations 8			
	2.3	Vector Addition of Forces 10			
	2.4	Addition of a System of Coplanar Forces 10			
	2.5	Cartesian Vectors 11			
	2.6	Addition and Subtraction of Cartesian Vectors 12			
	2.7	Position Vectors 12			
	2.8	Force Vector Directed Along a Line 13			
	2.9	Dot Product 13			
		Helpful Tips and Suggestions 13			
		Review Ouestions 14			

What's in This Package vii

Preface ix

1

3	Equili	brium of a Particle 15
	•	Main Goals of This Chapter 15
	3.1	Condition for the Equilibrium of a Particle 15
	3.2	The Free-Body Diagram 15
	3.3	Coplanar Force Systems 16
	3.4	Three-Dimensional Force Systems 16
		Helpful Tips and Suggestions 17
		Review Questions 17
4	Force	System Resultants 18
		Main Goals of This Chapter 18
	4.1	Moment of a Force—Scalar Formulation 18
	4.2	Cross Product 19
	4.3	Moment of a Force—Vector Formulation 20
	4.4	Principle of Moments 21
	4.5	Moment of a Force about a Specified Axis 21
	4.6	Moment of a Couple 22
	4.7	Simplification of a Force and Couple System 22
	4.8	Further Simplification of a Force and Couple System 24
	4.9	Reduction of a Simple Distributed Loading 24
		Helpful Tips and Suggestions 24
		Review Questions 24
5	Equili	brium of a Rigid Body 26
		Main Goals of This Chapter 26
	5.1	Conditions for Rigid-Body Equilibrium 26
	5.2	Free-Body Diagrams 26
	5.3	Equations of Equilibrium 27
	5.4	Two- and Three- Force Members 28
	5.5	Free-Body Diagrams 28
	5.6	Equations of Equilibrium 29
	5.7	Constraints and Statical Determinacy 29
		Helpful Tips and Suggestions 29
		Review Questions 30
6	Struc	tural Analysis 31
		Main Goals of This Chapter 31
	6.1	Simple Trusses 31
	6.2	The Method of Joints 32
	6.3	Zero Force Members 32
	6.4	The Method of Sections 32
	6.5	Space Trusses 33
	6.6	Frames and Machines 34
		Helpful Tips and Suggestions 34
		Review Questions 35
7	Internal Forces 36	
		Main Goals of This Chapter 36
	7.1	Internal Forces Developed in Structural Members 36
	7.2	Shear and Moment Equations and Diagrams 37

	7.3 7.4	Relations between Distributed Load, Shear, and Moment Cables 39 Helpful Tips and Suggestions 40 Review Questions 41			
8	Friction 42				
		Main Goals of This Chapter 42			
	8.1	Characteristics of Dry Friction 42			
	8.2	Problems Involving Dry Friction 43			
	8.3	Wedges 43			
	8.4 8.5	Frictional Forces on Screws 44 Frictional Forces on Flat Belts 45			
	8.6	Frictional Forces on Collar Bearings, Pivot Bearings, and Disks 46			
	8.7	Frictional Forces on Journal Bearings 47			
	8.8	Rolling Resistance 47			
	***	Helpful Tips and Suggestions 48			
		Review Questions 48			
9	Cente	er of Gravity and Centroid 49			
		Main Goals of This Chapter 49			
	9.1	Center of Gravity, Center of Mass, and the Centroid of a Body 49			
	9.2	Composite Bodies 50			
	9.3	Theorems of Papus and Guldinus 51			
	9.4	Resultant of a General Distributed Loading 51			
	9.5	Fluid Pressure 52			
		Helpful Tips and Suggestions 53 Review Questions 53			
10	Mom	ents of Inertia 54			
		Main Goals of This Chapter 54			
	10.1	Definition of Moments of Inertia for Areas 54			
	10.2	Parallel Axis Theorem for an Area 55			
	10.3	Radius of Gyration of an Area 55			
	10.4	Moments of Inertia for Composite Areas 56			
	10.5 10.6	Product of Inertia for an Area 56 Moments of Inertia for an Area about Inclined Axes 57			
	10.7	Mohr's Circle for Moments of Inertia 58			
	10.8	Mass Moment of Inertia 59			
		Helpful Tips and Suggestions 60			
		Review Questions 60			
11	Virtual Work 61				
		Main Goals of This Chapter 61			
	11.1	Definition of Work and Virtual Work 61			
	11.2	Principle of Virtual Work for a Particle and a Rigid Body 62			
	11.3	Principle of Virtual Work for a System of Connected Rigid Bodies 62			
	11.4	Conservative Forces 64			
	11.5 11.6	Potential Energy Criterion for Equilibrium 64			
	11.0	Potential Energy Criterion for Equilibrium 64 Stability of Equilibrium 65			
	11./	oracinty of Equinorium 03			

Procedure for Solving Problems 66
Review Questions 66

ANSWERS TO REVIEW QUESTIONS 67

>	Part II	Free-Body Diagram Workbook
	1 Pagia Camaa	mte in Statice 72

71

- 1 Basic Concepts in Statics 73
 - 1.1 Equilibrium **73**
- 2 Free-Body Diagrams: the Basics 75
 - 2.1 Free-Body Diagram: Particle **75**
 - 2.2 Free-Body Diagram: Rigid Body 78
- 3 Problems 83
 - 3.1 Free-Body Diagrams in Particle Equilibrium 85
 - 3.2 Free-Body Diagrams in the Equilibrium of a Rigid Body 115