Engineering Mechanics

STATICS

SI UNITS

MICHAEL E. PLESHA
GARY L. GRAY
FRANCESCO COSTANZO

TABLE OF CONTENTS

Prefa	Preface xiii		
1	Introduction		
	1.1	Engineering and Statics 1	
	1.2	A Brief History of Statics	
	1.3	Fundamental Principles	
	1.4	Force 8	
	1.5	Units	
	1.6	Newton's Law of Gravitation	
	1.7	Failure 17	
	1.8	Chapter Review	
2	Vec	tors: Force and Position	
	2.1	Basic Concepts	
	2.2	Cartesian Representation of Vectors in Two Dimensions 40 Introduction—Cartesian representation and a walk to work 40 Unit vectors 40 Cartesian coordinate system 41 Cartesian vector representation 41 Addition of vectors using Cartesian components 43 Position vectors 44	
	2.3	Cartesian Representation of Vectors in Three Dimensions 56 Right-hand Cartesian coordinate system 56 Cartesian vector representation 56	

		Direction angles and direction cosines 56 Position vectors 57 Use of position vectors to write expressions for force vectors 58 Some simple structural members 58
	2.4	Vector Dot Product
	2.5	Vector Cross Product
	2.6	Chapter Review
3	Equ	ilibrium of Particles107
	3.1	Equilibrium of Particles in Two Dimensions
	3.2	Behavior of Cables, Bars, and Springs
	3.3	Equilibrium of Particles in Three Dimensions
	3.4	Engineering Design
	3.5	Chapter Review
4	Мог	ment of a Force and Equivalent Force Systems 177
	4.1	Moment of a Force

4.2	Moment of a Force About a Line
4.2	Vector approach 194
	Scalar approach 195
4.3	Moment of a Couple
4.4	Equivalent Force Systems
4.5	Chapter Review
Equ	illibrium of Bodies
5.1	Equations of Equilibrium
5.2	Reactions 244 Free body diagram (FBD) 246 Alternative equilibrium equations 248 Gears 249 Examples of correct FBDs 250 Examples of incorrect and/or incomplete FBDs 250
5.3	Equilibrium of Bodies in Two Dimensions—Additional Topics
5.4	Equilibrium of Bodies in Three Dimensions
5.5	Engineering Design
5.6	Chapter Review

6	Stru	ctural Analysis and Machines 327
	6.1	Truss Structures and the Method of Joints
	6.2	Truss Structures and the Method of Sections
	6.3	Trusses in Three Dimensions
	6.4	Frames and Machines
	6.5	Chapter Review 386
7	Cer	ntroids and Distributed Force Systems 393
	7.1	Centroid
	7.2	Center of Mass and Center of Gravity
	7.3	Theorems of Pappus and Guldinus
	7.4	Distributed Forces, Fluid and Gas Pressure Loading
	7.5	Chapter Review 448

8	Inte	rnal Forces 455		
	8.1	Internal Forces in Structural Members		
	8.2	Internal Forces in Straight Beams		
	8.3	Relations Among Shear, Moment, and Distributed Force 476 Relations among V , M , and w 476 Determination of V and M using integration 477 Which approach should I use? 478 Tips and shortcuts for drawing shear and moment diagrams 479 Design considerations 480		
	8.4	Chapter Review		
9	Fric	tion		
	9.1	Basic Concepts		
	9.2	Problems with Multiple Contact Surfaces		
	9.3	Belts and Cables Contacting Cylindrical Surfaces 519 Equilibrium analysis 519		
	9.4	Chapter Review		
10	Moments of Inertia			
		Area Moments of Inertia		
		An example—test scores 531 An example—beam loading 532 Definition of area moments of inertia 532 What are moments of inertia used for? 533 Radius of gyration 534 Evaluation of moments of inertia using integration 535		

	10.2	Parallel Axis Theorem
	10.3	Mass Moments of Inertia
	10.4	Chapter Review 570
4	Tecl	nnical Writing577
В	Ans	wers to Selected Problems
	Cred	dits583
	Inde	×