## Contents

Preface			<i>page</i> xi
Notation		XV	
1	Physical Properties		1
	1.1	Dimensions and Units	1
	1.2	Water Properties	4
	1.3	Sediment Properties	6
2	Mechanics of Rivers		14
	2.1	Equations Governing River Flows	14
	2.2	<b>Equations Governing Sediment Motion</b>	33
	2.3	Why Do Rivers Form?	41
3	River Basins		47
	3.1	River Basin Characteristics	47
	3.2	Excess Rainfall Precipitation	49
	3.3	Surface Runoff	60
	3.4	Sediment Sources and Sediment Yield	69
4	River Basin Dynamics		83
	4.1	Rainfall Precipitation	83
	4.2	River Flow Duration Curves	96
	4.3	Flood Frequency Analysis	101
	4.4	Extreme Floods	108
5	Steady Flow in Rivers		116
	5.1	Steady-Uniform River Flow	116
	5.2	Steady Nonuniform River Flow	138
6	Unsteady Flow in Rivers		153
	6.1	Solitary Wave Propagation	153
	6.2	Kinematic and Dynamic Waves	154
	6.3	Flood-Wave Celerity	155

viii Contents

	6.4	Flood-Wave Propagation	159
	6.5	Short-Wave Propagation	164
	6.6	Flow Pulses in Rivers	165
	6.7	167	
7	Math	177	
	7.1	River Flood-Wave Propagation	177
	7.2	Advection–Dispersion of River Contaminants	186
	7.3	Aggradation-Degradation in Rivers	195
	7.4	Numerical River Models	198
8	Hillsl	205	
	8.1	Hillslope Stability	205
	8.2	Revetment Stability	214
9	River	230	
	9.1	Riverbank Stability	230
	9.2	River Flow-Control Structures	247
10	River	· Equilibrium	260
	10.1	Irrigation Canal Geometry	260
	10.2	Downstream Hydraulic Geometry	262
	10.3	River Meandering	276
11	River	Dynamics	292
	11.1	River Response	293
	11.2	River Degradation	299
	11.3	River Aggradation	311
12	Physi	330	
	12.1	Hydraulic Similitude	330
	12.2	Rigid-Bed River Models	333
	12.3	Sediment-Transport Similitude	338
	12.4	Mobile-Bed River Models	340
13	Strea	348	
	13.1	Watershed Environment	348
	13.2	Channel Rehabilitation	351
	13.3	Aquatic Environment	358
	13.4	Stream Restoration Guidelines	375
14	2 8		379
	14.1	River Flood Control	379
	14.2	River Closure and Local Scour	388
	14.3	Weirs and Canal Headworks	397
	14.4	Bridge Scour	402
	14.5	Navigable Waterways	408

	14.6 Dredging	418
	14.7 River Ice	421
15	River Estuaries	427
	15.1 Surface Waves	427
	15.2 River Estuaries	441

Bibliography Index Contents

ix

453 493