

CONTENTS

	Page
Preface	ix
1. Introduction	1
1.1 The Engineer's Role	2
2. Characteristics of Waters and Wastewaters	6
2.1 Physical Characteristics	6
2.2 Chemical Characteristics	8
2.3 Biological Characteristics	13
2.4 Typical Characteristics	14
3. Basic Analysis	17
3.1 Gravimetric Analysis	17
3.2 Volumetric Analysis	18
3.3 Colorimetric analysis	21
3.4 Electrodes	24
3.5 Significance of Results	25
3.6 Sampling	25
4. Basic Microbiology	28
4.1 Types of Metabolism	28
4.2 Types of Micro-organism	29
4.3 Plants	30
4.4 Animals	33
4.5 Taxonomy	35
4.6 Microbiological Examination	35
5. Biological oxidation of Organic Matter	39
5.1 Nature of organic Matter	39
5.2 Enzyme Reactions	41
5.3 Nature of Biological growth	42
5.4 Oxygen Demand in Aerobic Oxidation	44
5.5 Anaerobic Oxidation	49
6. River Pollution	53
6.1 Self-purification	55
6.2 Toxic materials	61
6.3 Overall Effects of Pollution	63
6.4 Control of River Pollution	66
7. Quantities of Water and Wastewater	69
7.1 Water Demand	69
7.2 Population growth	72
7.3 Wastewater Flow	73
7.4 Variations in Flow	75
8. Introduction to Treatment Processes	77
8.1 Methods of Treatment	79
8.2 Preliminary Treatment	79

9.	Sedimentation	82
	9.1 Theory of Sedimentation	82
	9.2 The Ideal Sedimentation Basin	85
	9.3 Measurement of Settling Characteristics	87
	9.4 Efficiency of Sedimentation Tanks	90
	9.5 Types of Sedimentation Tank	92
10.	Coagulation	96
	10.1 Colloidal Suspension	96
	10.2 Flocculation	97
	10.3 Coagulation	100
	10.4 Mechanism of Coagulation	
11.	Flow Through Porous Media	105
	11.1 Hydraulics of Filtration	105
	11.2 Filter Clogging	108
	11.3 Filter Washing	109
	11.4 Types of Filter	112
12.	Aerobic Biological Oxidation	115
	12.1 Principles of Biological Oxidation	115
	12.2 Types of Aerobic Oxidation Plant	118
	12.3 Percolating Filter	118
	12.4 Activated Sludge	122
	12.5 Oxidation pond	127
13.	Anaerobic Biological Oxidation	129
	13.1 Principles of Anaerobic Oxidation	129
	13.2 Applications of Digestion	131
	13.3 Operation of Digesters	132
14.	Disinfection	135
	14.1 Theory of Disinfection	135
	14.2 Chlorine	136
	14.3 Ozone	139
	14.4 Other Disinfectants	139
15.	Softening	141
	15.1 Chemical Precipitation	141
	15.2 Ion Exchange	145
16.	Sludge Dewatering and Disposal	149
	16.1 Principles of Dewatering	149
	16.2 Methods of Dewatering	151
	16.3 Disposal	154
17.	Water Reclamation	157
	17.1 Limits of Conventional Treatment	157
	17.2 Removal of Dissolved Solids	159
	17.3 Removal of Dissolved Organics	163
	17.4 Removal of Nitrogen	164
	17.5 Removal of Phosphorus	165
18.	Treatment Plant Design	166
	18.1 Water Treatment	166
	18.2 Sewage Treatment	170
	Index	175