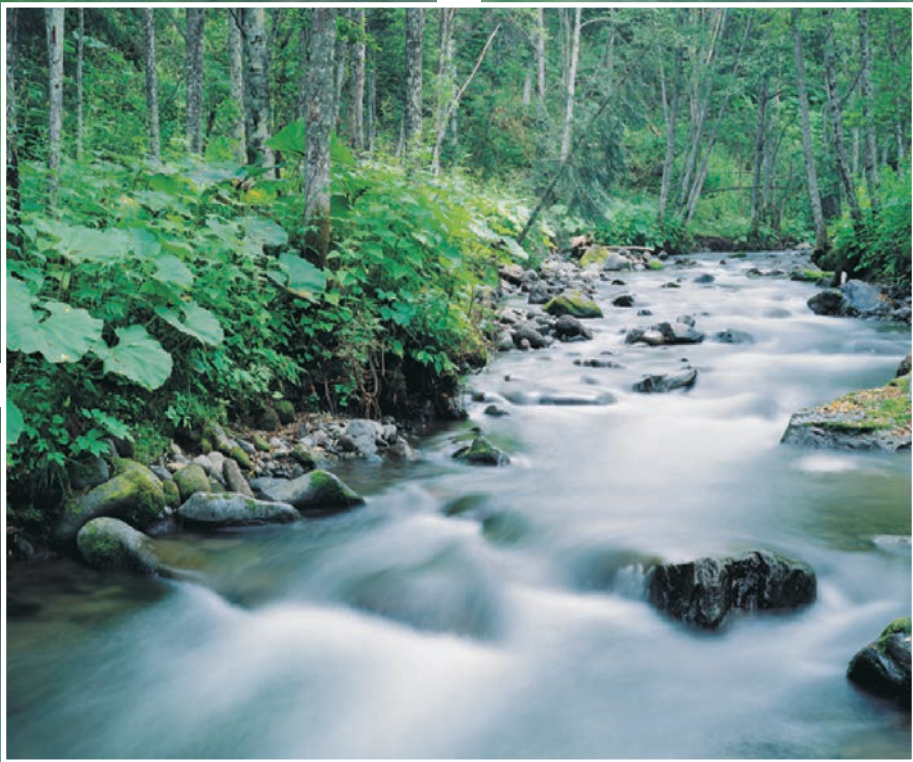


Eastern
Economy
Edition

Textbook of
**Environmental
Engineering**



P. Venugopala Rao

TEXTBOOK OF ENVIRONMENTAL ENGINEERING

P. VENUGOPALA RAO

Principal

Sridevi Women's Engineering College

Hyderabad

PHI Learning Private Limited

New Delhi-110001

2012

TEXTBOOK OF ENVIRONMENTAL ENGINEERING

by P. Venugopala Rao

© 2002 by PHI Learning Private Limited, New Delhi. All rights reserved. No part of this book may be reproduced in any form, by mimeograph or any other means, without permission in writing from the publisher.

ISBN-81-203-1930-1

The export rights of this book are vested solely with the publisher.

Eight Printing **January, 2012**

Published by Asoke K. Ghosh, PHI Learning Private Limited, M-97, Connaught Circus, New Delhi-110001 and Printed by Glorious Printer, Delhi-110092.

To my Parents

Sri P. Sambasiva Rao and Smt. P. Sitaramamma
and my wife Smt. P. Suseela

Contents

Preface

xi

1. ECOLOGY **1–14**

- 1.1 Introduction 1
 - 1.1.1 Biosphere 1
 - 1.1.2 Scope 2
 - 1.1.3 Ecosystems 3
- 1.2 Population Regulation 4
 - 1.2.1 Growth of Organisms 4
 - 1.2.2 Relationships 6
 - 1.2.3 Interactions 7
- 1.3 Natural Cycles 7
 - 1.3.1 Hydrological Cycle 8
 - 1.3.2 Carbon Cycle 8
 - 1.3.3 Nitrogen Cycle 8
 - 1.3.4 Sulphur Cycle 9
 - 1.3.5 Phosphorus 10
- 1.4 Energy Flow 10
- 1.5 Forests and Wild Life 11
- 1.6 Human Activities 11
- 1.7 Conclusion 12

Summary 13

Review Questions 13

Objective Type Questions 14

2. ENVIRONMENTAL SANITATION **15–37**

- 2.1 Community Health 15
 - 2.1.1 Significance 15
 - 2.1.2 Disease Transmission 16
 - 2.1.3 Principles of Sanitation 16
 - 2.1.4 Vector Control 17
 - 2.1.5 Housing Needs 20
 - 2.1.6 Community Sanitation Measures 21
 - 2.1.7 Health Education 22
- 2.2 Occupational Safety 22
 - 2.2.1 Hazards in Various Types of Occupation 22

- 2.2.2 Objectives of Occupational Health Plan 23
- 2.2.3 Prevention and Control 24
- 2.3 Refuse Disposal 26
 - 2.3.1 Constituents of Refuse 26
 - 2.3.2 Problems after Disposal 26
 - 2.3.3 Refuse Collection 26
 - 2.3.4 Recovery 28
 - 2.3.5 Parameters of Analysis 28
 - 2.3.6 Landfill 29
 - 2.3.7 Composting 29
 - 2.3.8 Incineration 30
 - 2.3.9 Plastics 30
- 2.4 Soil and Agricultural Pollution 31
 - 2.4.1 Top Soil 31
 - 2.4.2 Pollutants 32
 - 2.4.3 Parameters of Soil Analysis 32
 - 2.4.4 Remedial Measures 32
- 2.5 Noise Control 33
 - 2.5.1 Normal Sound Levels 33
 - 2.5.2 Ill Effects 33
 - 2.5.3 Noise Measurement 34
 - 2.5.4 Preventive and Control Measures 35

Summary 35

Review Questions 36

Objective Type Questions 36

3. DRINKING WATER

38–91

- 3.1 Water Quality 38
 - 3.1.1 Sources of Water 38
 - 3.1.2 Yield of a Well 39
 - 3.1.3 Impurities 41
 - 3.1.4 Water Quality at Source 45
 - 3.1.5 Drinking Water Quality Standards 46
 - 3.1.6 Water Quality for other Purposes 47
- 3.2 Water Supply 48
 - 3.2.1 Per Capita Demand 48
 - 3.2.2 Water Collection from Source 51
 - 3.2.3 Pipes and Appurtenances 52
 - 3.2.4 Water Distribution 57
 - 3.2.5 Service Reservoir 60
- 3.3 Water Purification 66
 - 3.3.1 Necessity of Purification 66
 - 3.3.2 Sedimentation 66
 - 3.3.3 Design Parameters 69
 - 3.3.4 Coagulation 73

- 3.3.5 Filtration 77
- 3.3.6 Disinfection 82
- 3.3.7 Other Methods 84
- 3.3.8 Rural Water Supply 88

Summary 88

Review Questions 88

Objective Type Questions 89

4. DOMESTIC SEWAGE 92–147

- 4.1 Sewerage System 92
 - 4.1.1 Introduction 92
 - 4.1.2 Methods of Sanitation 92
 - 4.1.3 Quantities of Sewage and Storm Water Flow 94
 - 4.1.4 Sewer Design 96
 - 4.1.5 Sewer Construction 101
 - 4.1.6 Sewer Appurtenances 102
 - 4.1.7 House Drainage 107
- 4.2 Sewage Characteristics 109
 - 4.2.1 Sewage Composition 109
 - 4.2.2 Decomposition of Sewage 110
 - 4.2.3 Biochemical Oxygen Demand (BOD) 112
 - 4.2.4 Chemical Oxygen Demand (COD) 115
 - 4.2.5 Solids 115
 - 4.2.6 Population Equivalent 116
- 4.3 Primary Treatment of Sewage 116
 - 4.3.1 Treatment Objectives 116
 - 4.3.2 Schematic Outline 117
 - 4.3.3 Screens 118
 - 4.3.4 Grit Chamber 119
 - 4.3.5 Primary Sedimentation Tank 120
 - 4.3.6 Skimming Tank 122
 - 4.3.7 Other Units 122
- 4.4 Biological Treatment 123
 - 4.4.1 General 123
 - 4.4.2 Trickling Filters 125
 - 4.4.3 Activated Sludge Treatment 127
 - 4.4.4 Oxidation Ponds 130
 - 4.4.5 Oxidation Ditch 131
 - 4.4.6 Rotating Biological Disc Contractors (RBC) 132
 - 4.4.7 Secondary Sedimentation Tank 132
- 4.5 Sludge Treatment and Disposal 133
 - 4.5.1 Sludge Characteristics 133
 - 4.5.2 Digestion of Sludge 133
 - 4.5.3 Sludge Drying Beds 136
 - 4.5.4 Sludge Conditioning 136
 - 4.5.5 Septic Tank 137

4.6	Ultimate Disposal of Sewage	139
4.6.1	Disposal into a River	139
4.6.2	Factors of Self Purification	139
4.6.3	Oxygen Sag Curve	140
4.6.4	Zones of Pollution	140
4.6.5	Disposal on Land	143
4.6.6	Land vs River Disposal	143
	<i>Summary</i>	144
	<i>Review Questions</i>	145
	<i>Objective Type Questions</i>	145
5.	WASTE WATER FROM INDUSTRIES	148–164
5.1	Pollutants	148
5.1.1	Harmful Effects	148
5.1.2	Waste Characteristics	149
5.2	Mixing of Industrial and Domestic Wastes	149
5.3	Pre-treatment of Industrial Wastes	152
5.3.1	Reduction of Waste Strength and Volume	152
5.3.2	Equalisation and Neutralisation	153
5.4	Various Industries	153
5.4.1	Dairy Plant	153
5.4.2	Cane Sugar and Distilleries	153
5.4.3	Fertiliser Industry	154
5.4.4	Paper Industry	154
5.4.5	Refineries and Petrochemicals	155
5.4.6	Pharmaceuticals	155
5.4.7	Steel Plants	155
5.4.8	Tanneries	156
5.4.9	Textile Units	156
5.4.10	Other Industrial Units	156
5.5	Removal of Solids	158
5.6	Special Processes	159
5.6.1	Removal of Chromium	159
5.6.2	Removal of Phenol	160
5.6.3	Removal of Mercury	160
5.6.4	Removal of Nitrogen	160
5.6.5	Removal of Dissolved Salts	160
5.7	Concepts of Common Effluent Treatment Plants (CETP)	161
	<i>Summary</i>	162
	<i>Review Questions</i>	163
	<i>Objective Type Questions</i>	163
6.	AIR POLLUTION	165–205
6.1	Pollutants: Sources and Effects	165
6.1.1	Introduction	165

6.1.2	Sources	165
6.1.3	Characteristics of Air Pollutants	169
6.1.4	Episodes	171
6.1.5	Harmful Effects	171
6.1.6	Atmospheric Reactions	173
6.1.7	Air Quality Permissible Limits	176
6.2	Dispersion of Pollutants	177
6.2.1	Atmospheric Factors	177
6.2.2	Air Movement	177
6.2.3	Heat Transfer	179
6.2.4	Atmospheric Stability	180
6.2.5	Mixing Depth	183
6.2.6	Plume Behaviour	184
6.2.7	Dispersion Theories	185
6.3	Removal of Particulate Matter	187
6.3.1	General	187
6.3.2	Settling Chambers	188
6.3.3	Cyclones	189
6.3.4	Wet Scrubbers	191
6.3.5	Bag Filters	193
6.3.6	Electrostatic Precipitators	194
6.3.7	Comparison	196
6.4	Control of Gaseous Impurities	196
6.4.1	Absorption	196
6.4.2	Adsorption	197
6.4.3	Condensation	198
6.4.4	Combustion	198
6.4.5	SO ₂ Control	199
6.4.6	NO _x Control	200
6.4.7	Indoor Ventilation	200
6.5	Selected Industries	201
	<i>Summary</i>	202
	<i>Review Questions</i>	203
	<i>Objective Type Questions</i>	204

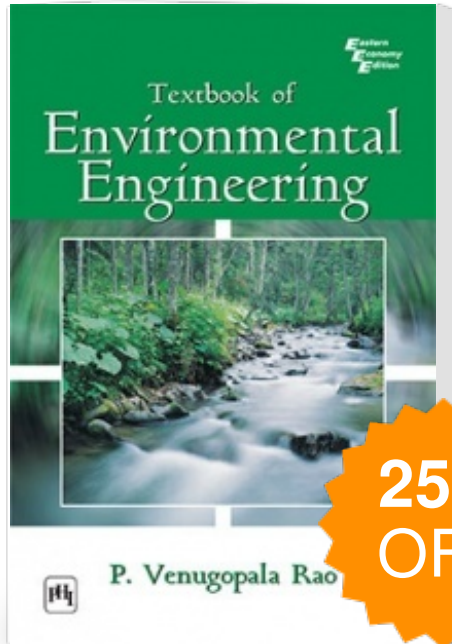
7. MONITORING AND ANALYSIS

206–222

7.1	Sampling	206
7.1.1	Purpose	206
7.1.2	Collection of Samples	206
7.1.3	Interpretation of Results	208
7.2	General Methods of Analysis	209
7.2.1	Volumetric and Gravimetric Analyses	209
7.2.2	Colour Comparison Method	209
7.2.3	Instrumentation	211

7.3	Analysis of Water and Waste Water	211
7.3.1	Physical Parameters	211
7.3.2	Chemical Examination	212
7.3.3	Bacteriological Examination	217
7.4	Air Quality Analysis	218
7.4.1	Suspended Particulate Matter	218
7.4.2	Gaseous Pollutants	218
7.5	Soil Analysis	221
	<i>Summary</i>	221
	<i>Review Questions</i>	221
	<i>Objective Type Questions</i>	222
8.	ENVIRONMENTAL MANAGEMENT	223–251
8.1	Environmental Impact Assessment	223
8.1.1	Introduction	223
8.1.2	Project Details	225
8.1.3	Environmental Attributes	226
8.1.4	Impact Evaluation Methodologies	229
8.1.5	Limitations of Study	234
8.1.6	Case Study—Power Plant	235
8.2	Environmental Audit	238
8.2.1	Meaning of Environmental Audit (EA)	238
8.2.2	Audit Items	238
8.2.3	Audit Procedure	239
8.2.4	Safety Audit	241
8.3	Pollution Control Board	242
8.3.1	Legal Aspects	242
8.3.2	Court Judgments	242
8.3.3	Functions of Pollution Control Board (PCB)	242
8.4	Environmental Management Plan	243
8.4.1	Management Aspects	243
8.4.2	Waste as a Resource	244
8.4.3	Objectives of ISO (International Organisation for Standardisation)	247
	<i>Summary</i>	249
	<i>Review Questions</i>	249
	<i>Objective Type Questions</i>	250
Appendix A		253–256
	Toxic Wastes	253
Appendix B		257–259
	Geographical Information Systems (GIS)	257
Appendix C		260–262
	Disaster Management	260
Bibliography		263
Index		265–268

Textbook Of Environmental Engineering



Publisher : PHI Learning

ISBN : 9788120319301

Author : Rao P Venugopala

Type the URL : <http://www.kopykitab.com/product/7769>



Get this eBook