

Contents

Preface	(v)
Introduction	(xv)

CHAPTER 1: FLOW OF FLUID

Types of Manometers	1
Absolute Manometer	3
Reynolds Number	5
Significance of Reynolds Number	6
Bernoulli's Theorem	7
Applications of Bernoulli's Theorem	9
Energy Losses	10
Orifice Meter	13
Venturi Meter	15
Pitot Tube	17
Rotameter	18
<i>Short Questions</i>	20
<i>Long Questions</i>	20

CHAPTER 2: SIZE REDUCTION

Objectives	21
Mechanisms of Size Reduction	22
Types of Crushers and Grinders	25
Laws Governing Size Reduction	26
Factors Affecting Size Reduction	29
Ball Mill	32
Working	33
Hammermill	33
Fluid Energy Mill	36

(viii) Contents

Edge Runner Mill	38
End Runner Mill	40
<i>Short Questions</i>	41
<i>Long Questions</i>	41

CHAPTER 3: SIZE SEPARATION

Objectives	43
Applications of Size Separation	44
Mechanism of Size Separation	44
Official Standards of Powders	45
Sieves.....	46
Size Separation Principles	49
Sieve Shaker	52
Cyclone Separator	53
Air Separator	55
Bag Filter	56
Elutriation Tank.....	58
<i>Short Questions</i>	62
<i>Long Questions</i>	62

CHAPTER 4: MIXING

Objectives	63
Types of Mixtures.....	64
Applications.....	65
Factors Affecting Mixing	69
Difference between Solid and Liquid Mixing	70
Mechanism of Mixing of Solid In Liquid.....	70
Mechanism of Powder Mixing	71
Mechanism of Liquids Mixing	72
Twin Shell Blender.....	74
Ribbon Blender.....	77
Sigma Blade Mixer.....	80

Planetary Mixers.....	82
Fluid Mixing Equipments.....	85
Turbines.....	86
Paddles.....	89
Silvers on Emulsifier.....	92
<i>Short Questions</i>	94
<i>Long Questions</i>	94

CHAPTER 5: CRYSTALLIZATION

Objectives.....	97
Applications.....	98
Theory of Crystallization.....	99
Solubility Curves.....	100
Agitated Batch Crystallizer.....	101
Swenson-Walker Crystallizer.....	104
Merits of Swenson Walker Crystallizer.....	105
Demerits of Swenson Walker Crystallizer.....	105
Krystal Crystallizer.....	105
Vacuum Crystallizer.....	107
Caking of Crystals.....	108
Factors Affecting Caking.....	109
Prevention of Caking.....	111
<i>Short Questions</i>	112
<i>Long Questions</i>	112

CHAPTER 6: EVAPORATION

Objectives.....	113
Applications.....	113
Factors Influencing Evaporation.....	114
Differences between Evaporation and Other Heat Transfer Processes.....	115
Evaporators.....	115
Steam Jacketed Kettle/Evaporating Pan.....	116

(x) Contents

Horizontal Tube Evaporator	117
Film Evaporators	119
Climbing Film Evaporator	119
Forced Circulation Evaporator	121
Multiple Effect Evaporator	123
Economy of Multiple Effect Evaporator	126
<i>Short Questions</i>	127
<i>Long Questions</i>	127

CHAPTER 7: HEAT TRANSFER

Objectives	129
Applications	129
Mechanisms of Heat Transfer	130
Fourier's Law	134
Heat Transfer by Conduction	135
Convection	136
Radiation	136
Heat Exchangers and Heat Interchangers	137
Heat Interchangers	138
Heat Exchangers	140
<i>Short Questions</i>	142
<i>Long Questions</i>	142

CHAPTER 8: DRYING

Objectives	143
Applications of Drying	144
Mechanism of Drying	145
Equilibrium Moisture Content	146
Measurements of Equilibrium Moisture Content	149
Applications of Equilibrium Moisture Content	151
Dryingrate Curve	151
Tray Dryer	156

Drum Dryer	158
Spray Dryer	160
Fluidized Bed Dryer	164
Vacuum Dryer	166
Freeze Dryer	168
Short Questions	174
Long Questions.....	174

CHAPTER 9: DISTILLATION

Objectives.....	175
Applications.....	176
Types of Distillation.....	176
Distillation.....	182
Simple Distillation.....	184
Laboratory Scale Simple Distillation	186
Industrial Scale Simple Distillation.....	187
Flash Distillation	189
Fractional Distillation.....	190
Distillation under Reduced Pressure.....	195
Steam Distillation	196
Molecular Distillation.....	199
<i>Short Questions</i>	<i>202</i>
<i>Long Questions</i>	<i>202</i>

CHAPTER 10: FILTRATION

Objectives.....	203
Applications.....	203
Theories	204
Factors Influencing Filtration	206
Filter Aids.....	208
Filter Medias.....	209
Plate & Frame Filter	209

(xii) Contents

Filter Leaf.....	214
Rotary Drum Filter.....	216
Meta Filter.....	218
Cartridge Filter.....	219
Membrane Filters.....	221
Seidtz Filter.....	223
<i>Short Questions</i>	225
<i>Long Questions</i>	226

CHAPTER 11: CENTRIFUGATION

Objectives.....	227
Principle.....	227
Applications of Centrifugation.....	229
Basket Centrifuge.....	231
Perforated Basket Centrifuge.....	232
Non-Perforated Basket Centrifuge.....	234
Semicontinuous Centrifuge.....	236
Super Centrifuge.....	238
<i>Short Questions</i>	240
<i>Long Questions</i>	240

CHAPTER 12: PLANT LOCATION, INDUSTRIAL HAZARDS AND PLANT SAFETY

Introduction.....	243
Plant Layout.....	245
Purpose of Plant Layout.....	246
Utilities.....	247
Services.....	248
Industrial Hazards.....	249
Classification of Hazards.....	249
Mechanical Hazards.....	251
Chemical Hazards.....	251
Fire Hazards.....	253

Explosive Hazards	256
Fire and Explosion Hazards	259
Control of Fire and Explosion	259
Industrial Safety	259
<i>Short Questions</i>	260
<i>Long Questions</i>	261

**CHAPTER 13: MATERIAL OF PHARMACEUTICAL PLANT CONSTRUCTION,
CORROSION, AND ITS PREVENTION**

Factors Affecting During Materials Selected for Pharmaceutical Plant Construction	263
Physical Factors	263
Chemical Factors	264
Economic Factors	265
Corrosion	266
Theories of Corrosion	267
Types of Corrosion	268
Prevention of Corrosion	275
Electroplating	279
Materials Used for Pharmaceutical Plant Construction	280
Nonferrous Metals	281
Inorganic Non-Metals	283
Organic Non-Metals	285
<i>Short Questions</i>	286
<i>Long Questions</i>	286

CHAPTER 14: MATERIAL HANDLING SYSTEM

Introduction	287
Objectives	288
Applications of Material Handling Systems	291
Different Types of Conveyors	293
Belt Conveyors	293
Screw Conveyors	296

(xiv) Contents

Horizontal Screw Conveyor	299
Pneumatic Conveyors.....	301
<i>Short Questions</i>	304
<i>Long Questions</i>	304
Conversation of Units from One System to Another.....	305
Exercises	313
Answers.....	337
Bibliography.....	339
Index.....	343