

# **Contents**

---

Preface .....	(xi)
Acknowledgements .....	(xiii)
Introduction .....	1

## **Section - I**

### **Heat Transfer**

<b>Chapter 1</b>	
Thickness of a Cylindrical Pipe Insulation .....	9
<b>Chapter 2</b>	
Unsteady State Conduction in Semi Infinite Slab .....	16
<b>Chapter 3</b>	
Counter Current Heat Exchanger .....	23
<b>Chapter 4</b>	
Unsteady State Conduction in a Slab .....	28
<b>Chapter 5</b>	
Flare Slack Height Estimation .....	54
<b>Chapter 6</b>	
Heat Equation – Stability Analysis using Explicit and Implicit Euler method .....	59

## **Section – II**

### **Fluid Flow**

<b>Chapter 7</b>	
Multistage Compressor .....	67

<b>Chapter 8</b>	
<b>Flare sizing .....</b>	<b>75</b>
<b>Chapter 9</b>	
<b>Pressure Drop in Pipelines.....</b>	<b>81</b>
<b>Chapter 10</b>	
<b>Flow in Tube – PDE Solver in MATLAB.....</b>	<b>99</b>
<b>Chapter 11</b>	
<b>Gravity Flow Tank .....</b>	<b>105</b>

### **Section - III** **Thermodynamics**

<b>Chapter 12</b>	
<b>Molar Volume Estimation using Equation of State Methods.</b>	<b>117</b>
<b>Chapter 13</b>	
<b>Bubble and Dew Point Estimation for Multi Component System .....</b>	<b>126</b>
<b>Chapter 14</b>	
<b>VLE Calculation for Multi-component System.....</b>	<b>132</b>
<b>Chapter 15</b>	
<b>CO<sub>2</sub> Vapor Pressure Regression .....</b>	<b>143</b>
<b>Chapter 16</b>	
<b>Rgress Feature – CO<sub>2</sub> Emissions.....</b>	<b>149</b>

### **Section - IV** **Mass Transfer**

<b>Chapter 17</b>	
<b>Dynamics of Binary Distillation Column .....</b>	<b>157</b>

## **Section - V**

### **Chemical Reaction Engineering**

<b>Chapter 18</b>	
<b>Plug Flow Reactor.....</b>	<b>163</b>
<b>Chapter 19</b>	
<b>Batch Reactor with Series Reaction .....</b>	<b>166</b>
<b>Chapter 20</b>	
<b>Non-isothermal Plug Flow Reactor .....</b>	<b>171</b>
<b>Chapter 21</b>	
<b>Non-Isothermal CSTR.....</b>	<b>177</b>
<b>Chapter 22</b>	
<b>Fluidized Bed Reactor .....</b>	<b>183</b>

## **Section - VI**

### **Equipment Design**

<b>Chapter 23</b>	
<b>Three Phase Separator .....</b>	<b>191</b>
<b>Chapter 24</b>	
<b>Control Valve Sizing.....</b>	<b>197</b>
<b>Chapter 25</b>	
<b>Single Effect Evaporator .....</b>	<b>205</b>
<b>Chapter 26</b>	
<b>Column Design using FUG Method .....</b>	<b>208</b>

**(viii) *Contents***

---

**Chapter 27**

<b>Shell and Tube Heat Exchanger Design using Kern Method .....</b>	<b>214</b>
---	------------

**Chapter 28**

<b>Centrifuge Design.....</b>	<b>228</b>
-------------------------------	------------

**Section - VII**  
**Process Control**

**Chapter 29**

<b>Basics of Process Control .....</b>	<b>233</b>
--	------------

**Chapter 30**

<b>Simulation of Temperature Control of Water Tank .....</b>	<b>243</b>
--	------------

**Chapter 31**

<b>PID Control of Three CSTR's in Series.....</b>	<b>247</b>
---	------------

**Chapter 32**

<b>Dynamics of Second Order Systems.....</b>	<b>254</b>
--	------------

**Section - VIII**  
**Process Simulation**

**Chapter 33**

<b>Ammonia Plant Model with Recycle Loop .....</b>	<b>259</b>
--	------------

**Chapter 34**

<b>Condensate Stabilizer Plant .....</b>	<b>264</b>
--	------------

**Chapter 35**

<b>Refrigeration Loop.....</b>	<b>272</b>
--------------------------------	------------

**Chapter 36**

<b>Predictive Control of a Wastewater Treatment Process .....</b>	<b>278</b>
---	------------

**Chapter 37**

**Boiler Efficiency Theory.....284**

**Appendix-I Basics of COMSOL.....288**

**Appendix-II MATLAB Basics.....307**