Unit Operations in Chemical Plants

Duration: 24 Hours (3 days)

Course Overview:

Unit operations are the fundamental physical processes involved in chemical engineering. These processes help in transforming raw materials into desired products through separation, heat transfer, mass transfer, fluid flow, and mechanical operations.

Target Audience:

- Junior Engineers
- Chemical Engineers
- Process Engineers
- Design Engineers
- Plant Engineers
- Engineering Refreshers

Course Outline:

Day 1

Module 1: Introduction

- What are Unit Operations?
- Typical Unit Operations in Chemical Engineering

Module 2: Momentum Transfer Operations

- Introduction to Momentum Transfer Operations
- Pressure Changers
- ERRATA - Lecture 7 - OD & ID
- Piping & Fittings
- Piping - Models
- Piping - P&ID Symbols
- Momentum - Reference
- Fittings - General
- Fittings - Models
- Fittings - P&ID Symbol
- Fluid Metering - General
- Fluid Metering - Models
- Fluid Metering - P&ID Symbol
- Agitation & Mixing - General
- Agitation & Mixing - Models
- Agitation & Mixing - P&ID Symbol
- Pumps - General Overview
- Kinetic / Centrifugal Pumps
- Cavitation
- Pump & System Curves
- Series vs. Parallel Pumps
- Fans & Blowers
- Compressors – General & Model

- Fluidization Introduction
- Fluidization Bed – Applications
- Fluidized Bed - P&ID Symbols

Day 2:

Module 3: Introduction to Heat Transfer Operations

- Heat Transfer
- Heat Transfer Reference
- Shell & Tube Exchanger
- Plate Exchangers
- Spiral Exchangers
- Tubular Exchangers
- Heat Exchangers Models
- Heat Exchangers - P&ID Symbols
- Condensers
- Condensers - Utilities
- Condensers - P&ID Symbol
- Evaporators & Reboilers - General
- Kettle Reboiler
- Thermosyphone
- Evaporators - P&ID Symbos
- Furnace - General
- Furnace - P&ID Symbol

Module 4: Mass Transfer Operations

- Introduction to Mass Transfer Operations
- Gas Dispersion - General
- Sparged Vessel (Bubble Column)
- Tray Towers
- Bubble Cap Trays
- Sieve Trays
- Liquid Dispersion - General
- Venturi Scrubber
- Spray Towers
- Wetted Wall Towers
- What is Absorbtion?
- Singel vs. Multiple Stages
- Absorber Columns
- Sour Gas - Absorption/Stripping Example
- What is Flashing?
- Flash Drum
- Distillation - General
- Binary Distillation - General
- Binary Distillation - Models
- Column Design

Day 3:

Module5: Distillation

- Multicomponent Distillation
- Fractionation Column
- Distillation Columns - PID
- Liquid-Liquid Extraction
- Solvent Selection
- Ternary Diagrams
- Column Equipment for Liq-Liq Extraction
- Mixer -Setller Extractors
- What is Adsorption?
- What is Drying?
- Psychrometric Chart (Humidity content of Air)
- Batch Dryers
- Tunnel Dryers
- Turbo Type Dryer
- Rotatory Dryer
- What is Crystallisation?
- Crystallisers

Module 6: Reactor Engineering

- Introduction to Reactor Engineering Operations
- Reactor Engineering Overview
- Batch Reactors
- Continuous Stirred Tank Reactor (CSTR)
- Plug Flow Reactor (PFR)
- Packed Bed Reactor (PBR)

Module 7: Process Diagrams

- Introduction to PFD & P&ID
- What is a PFD?
- Process Flow Diagrams
- P&ID Intro
- P&ID Exercises