Distillation columns: Principles, Operation & Design

Duration: 8 Hours (1 day)

Course Overview:

Distillation columns of various designs and applications are encountered nowadays throughout petroleum refining, petrochemical, chemical and process industries. This course is designed to provide you with a complete understanding of **construction details** and **functioning** of distilling columns. This understanding is a prerequisite for **successful operation** of your plant.

Target Audience:

- Chemical engineers
- Process engineers
- Design engineers
- Process control personnel and technical staff in the refining, petrochemicals, chemical and process industries
- Production and Shift Supervisors in charge of distilling columns
- Field Operators
- Experienced field operators preparing for console operations

Course Outline:

Day 1

Module 1: Introducing the Distillation Process

- What is distillation?
- Types of distillation processes
- Limits of distillation
- Concept of volatility
- Distillation practices
- Distillation column operation in 3D
- Vapor Liquid contact

Module 2: Vapor – Liquid Equilibrium of Pure Components

- Introduction
- Vapor Liquid Equilibrium
- Vaporization of a pure component at constant pressure
- Condensation of a pure component at constant pressure
- Boiling point
- Vaporization and Condensation of a pure component at different pressures
- Vapor pressure curve
- Vapor pressure curve : The case of water
- More on vapor pressure curves
- Flash vaporization
- Heat of vaporization
- Critical point
- VLE : What you need to know for pure components
- Enthalpy diagram for a pure component 1/3
- Enthalpy diagram for a pure component 2/3

- Enthalpy diagram for a pure component 3/3
- PRACTICE SESSION #1 : Ethylene / Ethane fractionator
- PRACTICE SESSION #2 : Reboiler operation

Module 3: Vapor – Liquid Equilibrium of Mixtures

- Vaporization of a hydrocarbon mixture at constant pressure
- What do we learn?
- Vapor - Liquid Equilibrium of mixtures
- Vapor pressure of mixtures
- Raoult's law
- Dalton's law
- Concept of Equilibrium Coefficient
- Scheibel and Jenny Chart
- Concept of Relative Volatility
- Relative volatility: Industrial applications
- Relative volatility: Effect of pressure
- VLE : What you need to know for mixtures

Module 4: Distillation Practices

- Drilling Stages & Drilling Rigs
- A typical distillation column
- Industrial application: The depropanizer (Steam Cracking Process)
- Industrial application: The depropanizer Material Balance
- Reflux drum pressure
- Pressure profile
- Simple pressure control
- Complex pressure control
- Overhead composition control
- Alternative control strategies
- Overall thermal balance
- Condenser thermal balance
- Optimum Reflux Ratio
- Concentration and temperature profiles - Binary distillation
- Concentration profiles - Complex mixtures
- Temperature profile - Complex mixtures

Module 5: Distillation Equipment

- Production & Perforations
- Platform Processing
- Introduction
- The shell
- The trays
- Tray arrangements
- Tray types
- Packings
- Packing support
- Liquid distributors
- Collector trays
- Packing restrainers
- Combined Tray / Packed distilling column

- The reboiler
- The condense

Module 6: Assessing Distilling Column Performance using Aspen Plus

- Learning objectives
- The base case
- Effect of reflux ratio
- Effect of feed stage location
- Effect of feed temperature