



**Chemical, Mechanical Engineering**



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# Course: Chemical Engineering for Non\_Chemical Engineers

| Code | City                | hotel              | Start      | End        | price  | Hours |
|------|---------------------|--------------------|------------|------------|--------|-------|
| 551  | Munich<br>(Germany) | Hotel Meeting Room | 2024-04-22 | 2024-05-03 | 7950 € | 50    |

## Course Overview

This course is aimed at non-chemical engineers who need an overview of the function, principles, requirements, and operation of typical chemical process equipment and who need to communicate effectively with chemical / process engineers by gaining a basic understanding of the operational factors and design equations that are used by chemical engineers and how chemical engineering relates to their disciplines.

## What you will learn

- Role, need, and goal of chemical engineering in today's world
- Three elements of process plants including equipment, utilities, and instrumentation and control
- Process engineers knowledge Concepts, Skills, Deliverables, Codes & Standards
- Process engineering concepts related to two main elements of chemical engineering; material and material changes; including: different material phases (solid, liquid and gas), fluid properties, gas law, material properties, physical operations vs. chemical processes, etc.
- Different process discipline deliverables including: BFD, PFD, P&ID, H&MB Table, process design criteria and process design basis, process description, process control narrative, and cause and effect table and gaining ability to read and interpret them
- Concepts and applications of different process elements including: pipes, valves, automatic valves (switching valves and control valves), containers (vessels and tanks), fluid movers (pumps, compressors, blowers, fans), heat exchangers, and furnaces
- Common principles of "change" either physical or chemical
- Different unit operations including Gravity Separation, Filtration, Absorption & Adsorption, Evaporation, Distillation, Crystallization, Centrifugation, Drying, Extraction, Leaching, Membrane separation, Cyclones, Humidification, and Dehumidification
- Safety requirements of process plant and technical and legal issues related to Pressure Relief Devices (PRD) including Pressure Safety Valves (PSV) and rupture discs in the process plants
- Impact of process plants on three elements of environment, air, water, and soil
- Risk management and risk management tools in process industries including HAZOP
- Profitability of process plants including capital, operating cost, and unit product cost estimation
- Material of construction in process plants and different mechanisms of material loss including corrosion and erosion.



## Course Outline

### Day 1

#### **Chemical Engineering**

- What is this course about?
- What is chemical engineering about?
- What do chemical engineers study in university and why?
- Which sectors do chemical engineers work in?
- Different types of Process industries
- What do we need to study to learn chemical engineering quickly?
- Process Plants: A tangible way to start learning chemical engineering
- Process Plant Elements: Equipment, Utility Generation & Network, and Instrumentation & Control (I&C)

### Day 2

#### **Process Industries Elements: Equipment and Pipes (Applications)**

- Fluid Conductors: Pipes, Tubes, Ducts
- Pipe Appurtenances: Fitting and Valves
- Fluid Movers: Pumps and Compressors
- Containers: Tanks, Vessels
- Heat Transfer Equipment: Heat Exchangers, Furnaces
- Unit Operations and Unit Processes

#### **Process Industries Elements: Utility**

- Different Utilities in Plants
- Utilities Generation
- Utility Distribution and Collection Networks
- Permanent vs. Temporary Utility Users

### Day 3

#### **Process Industries Elements: Instrumentation and Control**

- The Value of Control; and Parameters of Interest
- Three Layers of Integrated Control & Safety System (ICSS): BPCS, Alarm, and SIS
- Control Loop: Duty and Components
- Three Main Elements of Control Loops: Control Architecture, Control Strategy, and Tuning
- Primary Elements: Sensors and Meters
- Final Elements: Control Valves



- Safety Instrumented Function: Duty and Components
- Final Elements: Switching Valves
- Alarm System: Duty and Components

## **Day 4**

### **Chemical Engineers' Assets - Part 1**

- Chemical Engineers' Assets: Concepts, Skills, Deliverables, Codes & Standards
  - A - Process Engineering Discipline Deliverables
    - BFD (Block Flow Diagram)
    - PFD (Process Flow Diagram)
    - Plot Plan; and Site Selection
    - P&ID (Piping & Instrumentation Diagram)
    - H&MB Table (Heat & Material Balance)
    - Equipment Datasheets
    - Process Description and Process Control Narrative
    - Datasheets
    - Utility Consumption Table
    - Chemical Consumption Table
    - Shut-Down Key Table
    - Alarm Set Point Table
  - B - Process Engineers' Skills
    - Calculation
    - Study Report
    - SOP (Standard Operating Procedure)
    - Scope Definition Document
  - C - Process Engineering Standards and Codes
    - Standards vs. Codes
    - Common Standards in Chemical Engineering
    - Common Codes in Chemical Engineering
  - D - Process Engineering Concepts

## **Day 5**

### **Substances**

- Material Phases: Solids, Liquids, and Gasses
  - Phase Behaviour
  - Gas Laws
  - Material Properties
  - Properties of Flowable Solids
  - Change: Physical or Chemical



- Physical Change: Macro-Change, Micro-Change (Phase and Component Changes)
- Chemical Change: Reactions
- Principles of Material Change
  - Mass Transfer and Energy Transfer (Potential and Kinetic)
  - Transfer Phenomena: Heat Transfer, Mass Transfer; and Momentum Transfer
  - Conservation of Energy, Mass; and Momentum
  - Energy Balance, Mass Balance

## **Day 6**

### **Process Industries Elements: Equipment and Pipes (Concepts)**

- Fluid Conductors: Pipes, Tubes, Ducts
- Fitting and Valves
- Fluid Movers: Pump and Compressors
- Containers: Tanks, Vessels
- Mixing and Agitation
- Heat Transfer Equipment: Heat Exchangers, Furnaces
- Unit Operations and Unit Processes
- Flowable Solid Transfer

## **Day 7**

### **Common Principles of Change**

- Type of change: Physical or chemical
- Possibility (thermodynamic) and speed (Kinetics)
- End point vs. equilibrium point
- Phase equilibrium and Reaction equilibrium
- Containers for "change"

### **Unit Operations: Solid Handling**

- Size reduction (comminution)
- Crushers
- Grinders

## **Day 8**

### **Unit Operations: Separation Methods - Part 1**

- Screening
- Gravity Separation
- Filtration



- Absorption & Adsorption
- Evaporation
- Distillation
- Crystallization
- Centrifugation
- Drying
- Extraction
- Leaching
- Membrane
- Cyclones
- Cooling Towers, Humidification, and Dehumidification

## **Day 9**

### **Process Units: Reactions**

- What is a reactor?
- Different types of reactors: Plug and Mixed
- Single Phase vs. Multiphase
- Endothermic vs. Exothermic

## **Day 10**

### **Process Plant Design**

- **Batch vs. Continuous**
- Steady State vs. Unsteady State
- Hierarchy of Document Generation
- Simulation
- Sizing vs. Specification
- Series and Parallel Process Items



**The Scandinavian Academy employs modern methods in training and skills development, enhancing the efficiency of human resource development. We follow these practices:**

- **Theoretical Lectures:**
  - We deliver knowledge through advanced presentations such as PowerPoint and visual materials, including videos and short films.
- **Scientific Assessment:**
  - We evaluate trainees skills before and after the course to ensure their progress.
- **Brainstorming and Interaction:**
  - We encourage active participation through brainstorming sessions and applying concepts through role play.
- **Practical Cases:**
  - We provide practical cases that align with the scientific content and the participants specific needs.
- **Examinations:**
  - Tests are conducted at the end of the program to assess knowledge retention.
- **Educational Materials:**
  - We provide both printed and digital scientific and practical materials to participants.
- **Attendance and Final Result Reports:**
  - We prepare detailed attendance reports for participants and offer a comprehensive program evaluation.
- **Professionals and Experts:**
  - The programs scientific content is prepared by the best professors and trainers in various fields.
- **Professional Completion Certificate:**
  - Participants receive a professional completion certificate issued by the Scandinavian Academy for Training and Development in the Kingdom of Sweden, with the option for international authentication.
- **Program Timings:**
  - Training programs are held from 10:00 AM to 2:00 PM and include buffet sessions for light meals during lectures.