



PE235: Process Engineering and Safety

Training Description:

This intensive course covers the application of chemical engineering theory to the practical demands of applied process engineering. The course will be presented in interactive format with many industrial examples and case studies. Participants will have the opportunity to solve sample problems with the help of the instructor.

The first part of the course will cover the basics of unit operations and the development of an effective process. Topics included are the preparation of process flow diagrams (PFDs) and P&IDs. These diagrams represent the organization and control of equipment in a petrochemical plant or refinery. This is followed by the calculation of material flows and the concept of a material balance. Included are techniques on the sizing and evaluation of piping networks (including pipe segments, fittings, parallel piping systems, valves and controls equipment).

Pressure drop calculations are presented for a variety of systems – ordinary Newtonian liquids, vapors and mixed phase systems, reacting systems, packed beds and fluidized beds.

Next, the design and evaluation of major fluid flow equipment is presented. This includes pumps (all types) and compressors as well as fans, vacuum pumps, ejectors and eductors. The associated drivers for these machines are discussed, especially steam turbines and the steam-power cycle found in all petrochemical plants and refineries. The materials portion of the course is followed by a presentation on energy balances and heat transfer equipment. Refrigeration energy balance, compressor selection, and power requirements are covered. Focus is on the cycles typically found in refineries and petrochemical plants, including cascaded and open systems.

In the next section of the course, materials of construction (MOC) are discussed and selection guidelines presented. Finally, heat transfer equipment selection, design and rating are discussed.

On completion of this course, participants will have the ability to understand and prepare PFDs and P&IDs, perform material/heat balance and fluid flow calculations. Participants will also be able to design, rate and select the major process equipment which accounts for most of the capital investment in refineries and petrochemical plants.

During the course, participants will be given detailed procedures and worksheets for performing the appropriate calculations. Many of the examples have been developed on EXCEL; these programs will be given to the participants on a CD. The tools provided should aid in the design and operation of chemical systems. This is an interactive course with numerous case studies and a CD with solved problems, worksheet and shortcut techniques.

Training Objectives:

By the end of the training, participants will be able to:

- ✓ Apply and gain an in-depth knowledge on process engineering and discuss the chemical & physical aspects as well as the processes and process variables used in applied process engineering
- ✓ Prepare PFDs and P&IDs in a professional manner
- ✓ Perform material/heat balance and fluid flow calculations
- ✓ Acquire knowledge with the various process development including process sketch, diagrams and unit operations

- ✓ Employ the application of fluid dynamics specifically its piping system design and flow systems and determine the different flow equipment used in process engineering
- ✓ Enumerate heat transfer components by explaining the elements of energy balances, heat exchangers, air coolers and fired heaters
- ✓ Develop an understanding on mass transfer attributes including distillation, tray performance & constraints, humification and refrigeration
- ✓ Identify the different types of chemical reactors and describe petroleum processing reactions including hydro treating, catalytic reforming & hydro cracking
- ✓ Discuss the process control applied in process engineering and identify the various construction materials as well as the method of selecting the materials to be used
- ✓ Carryout process risk analysis particularly the various evaluation methods and HAZOP study

Training Designed for:

This course is intended for Process and Project Engineers as well as Piping Designers. The course will also be valuable as a refresher for experienced Chemical Engineers and those who are not familiar with some aspects of applied process engineering. Additionally, Managers and Supervisors who have no formal training in chemical engineering should find value in this course.

Training Requirement:

“Hand’s on practical sessions, equipment and software will be applied during the course if required and as per the client’s request.”

Simulator (Hand on Practical Sessions) Practical sessions will be organized during the course for participants to practice the theory learnt. Participants will be provided with an opportunity to carryout various exercises using “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor”, “CBT on Compressors”, “Steam Turbines & Governing System CBT”, “Heat Exchanger Tube Layout”, “Gas Ultrasonic Meter (USM) Sizing Tool”, “Liquid Turbine Meter and Control Valve Sizing Tool”, “Liquid Ultrasonic Meter Sizing Tool” and “Orifice Flow Calculator” simulator.

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client’s learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Program:

DAY ONE:

- ❖ PRE-TEST
- ❖ Introduction
- ❖ Process Engineering
 - Process Engineering Overview
- ❖ Chemical & Physical Principles
 - Dimensions and Units
 - Processes and Process Variables
 - Process Data Representation and Analysis
 - Basic Chemical Calculations

- Stoichiometry
- Properties of Matter
- ❖ **Process Development**
 - Process Sketch
 - Block Diagram
 - Process Flow Diagrams (PFDs)
 - Piping and Instrumentation Diagrams (P & IDs)
 - Other Diagrams
 - Unit Operations
- ❖ **Fluid Dynamics**
 - Static Fluids
 - Fluid Flow

DAY TWO:

- ❖ **Fluid Dynamics (cont'd)**
 - Piping Systems Design
 - Complex Flow Systems
 - Miscellaneous Flow Systems
- ❖ **Flow Equipment**
 - Fluid Flow Equipment Drivers and Power Cycles
 - Compressible Flow Piping – Safety and Control
 - Pumps, Basic Concepts, Cavitation
 - Compressors
 - Fans
 - Agitation & Mixing
 - Filtration
- ❖ **Heat Transfer**
 - Energy Balances
 - Heat Exchangers Overview

DAY THREE:

- ❖ **Heat Transfer (cont'd)**
 - Heat Exchangers Design
 - Shell & Tube Heat Exchangers (TEMA Type)
 - Air Coolers
 - Fired Heaters
- ❖ **Mass Transfer**
 - Physical Behavior Pure Components
 - Distillation

DAY FOUR:

- ❖ **Mass Transfer (cont'd)**
 - Calculation Methods
 - Trays Performance and Constrains, Tray Efficiency
 - Crude Unit Optimization
 - Packing, Trays versus Packing Comparison



- Humification & Refrigeration
- ❖ **Chemical Reactors**
 - Petroleum Processing Reactions
 - Kinetics
 - Reactor Types
- ❖ **Practical Sessions**
 - This hands-on, highly-interactive course includes real-life case studies and exercises

DAY FIVE:

- ❖ **Process Control**
 - PID Controllers
 - Feedback, Feed Forward and Cascade Controls
 - DCS Advanced Control
- ❖ **Materials of Construction**
 - Selection Criteria
 - Construction Materials
 - Code & Standards to Avoid Catastrophes
 - Material Selection (Ferrous Material, Non-Ferrous Material, others)
 - Corrosion Considerations
- ❖ **Process Risk Analysis**
 - Risk Priority Matrix
 - Evaluation Methods
 - HAZOP Study
- ❖ Course Conclusion
- ❖ POST-ASSESSMENT and EVALUATION

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

CMCT Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Fees:

TBA as per the course location - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

For training registrations or in-house enquiries, please contact:

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