Online Certificate in Process Engineering for Control Practitioners

The majority of people who want to get into Process Instrumentation and Control (PIC), or who are already in this discipline, do not have the background to understand basic Process Engineering. It is often learned over the years - the hard way. This learn-as-you-go approach takes many years to achieve and still results in an incomplete understanding of Process Engineering.

The attendees will learn the basics of Process Engineering as they relate to PIC. The importance of knowing basic process engineering for practitioners is vital in being able to implement PIC systems correctly.

Who Should Enroll

This course is geared to all personnel (engineers, designers, technicians, sales personnel, etc.) working in the field of PIC.

Course Objectives

1. Describe the roles of the common instrumentation and control equipment used in the process industry.
2. Decipher piping and instrumentation diagrams (P&IDs)
3. Select and apply the proper control architectures used in the process industry.
4. Employ the 8 steps to provide a protective safety layer at a production facility.

Course Outline

Module 1 – Process Engineering Concepts

Session 1 - Process Industries

What is this course about?

Process industries vs. manufacturing Industries (oil & gas, water & wastewater, food, mineral processing, etc.)

Session 2 - Process Industries Elements

Plant Elements: Equipment, Utility Generation & Network

A - Equipment

Fluid Conductors: Pipes, Tubes, Ducts

Fluid Movers: Pump and compressors

Containers: Tank, Vessel

Heat Exchange Equipment: Heat Exchangers, Furnaces

Unit Operations and Unit Processes: Reactors, Separators etc.

B - Utility

Different Utilities in Plants

Utility Distribution and Collection Network

Session 3 - Process Engineering Concepts & Calculations
- Physical Operations vs. Chemical Processes
- Different Material Phases: Solid, Liquid (Newtonian vs. Non-Newtonian), and Gas
- Hydraulic Calculation
- Pump Calculation
- Control Valve Hydraulic Calculation
- PSV Hydraulic Calculation

Session 4 - Process Discipline Deliverables (related to control practitioners)
- BFD (Block Flow Diagram)
- PFD (Process Flow Diagram)
- P&ID (Piping & Instrumentation Diagram)
- H&MB (Heat & Material Balance) Table
- Equipment Data Sheets (Process Inputs)
- Process Description and Process Control Narrative
- Shut-down Key Table (Process input)

Session 5 - P&ID Understanding
- Different Types of P&ID's
- Anatomy of a P&ID Sheet
- Involved Parties in P&ID Development
- Different P&ID Milestones: IFR, IFA, IFD, IFC, As-built, Debottlenecking
- General rules of P&ID
- Pipes
- Manual Valves & Automatic Valves
- Containers
- Fluid Movers
- Heat Exchangers
- Pressure Safety Devices
- Insulation & Tracing

Module 2 – Process Engineering Aspects of Control, SIS and Alarming

Session 1 - Developing "I" Portion of P&ID
- Plant Parameters: Process Parameters vs. Non-process Parameters
- Different Levels of Parameters
- Monitoring vs. Controlling
- Degrees of Freedom in Control
- Locating Disturbance

Session 2 - Application of Control Architectures
- Manual Set Point vs. Remote Set Point
- FB vs. FF Control and Combined
- Cascade Control
- Ratio (Relation) Control

Selective Control
Override Control
Split & Parallel Range Control

Session 3 - Plant Wide Process Control
Surge Management: Prevention, Dampening, and Rejection
Material Balance Control
Product Quality control

Session 4 - Unit Operation Process Control
Control for Flow Merging and Splitting
Pump Control
Compressor Control
Heat Exchanger Control
Container Control
Gravity Separators Control
Other Units
Electro-motor Control
Turbine Control

Session 5 - SIS Loops
Duty of SIS actions
Layers of Protection
Anatomy of Safety Instrumented Function (SIF)
Deciding on Requirements of SIS Loops in Plants
Providing Required Reliability
Hazop (Hazard & Operability Study) and Other Structured Risk Assessment Tools
How to Close-out a "Hazop Recommendation"

Module 3 – Pressure Safety Devices
Session 1 - Safety Requirement of Plants
Why "Pressure" Is So Important
Plant Protection Strategies
Pressure Vessel and Tanks
Regulatory Issues Involved in PSV's (Pressure Safety Valve)

Session 2 - Different Types of PSD's (Pressure Safety Devices)
Different Types of PSD's: PSV's, Rupture Discs
PSV Classification based on structure: Weight Type, Spring Conventional, Bellows Type, and Pilot Type
PSV Classification Based on Protected System: Safety Valve, Breather Valve

Session 3 - 8 Steps of Providing a Protective Layer

- Locating PSD's
- Positioning PSD's
- Defining Scenarios
- Specifying Set Pressure and Calculating Release Rate
- Calculating Required Orifice Size
- Selecting Right Type of PSD
- Selecting Right Type of PSD Arrangement
- Checking Functionality of PSD: Inlet Pressure Drop %, Outlet Pressure Drop %, Operating Pressure %

Session 4 - PSV Sizing

- Pressurization Scenarios
- Fire
- Thermal Expansion
- Control Valve Failed/Jammed Open
- Gas Blow-by
- Blocked Flow
- Shell & Tube Heat Exchanger Tube Rupture
- High Viscosity Liquid Release
- Liquid vs. Vapor/Gas Release
- Two Phase Flow Release
- Miscible vs. Immiscible Liquid Release
- PSV Data Sheets

Certificate Requirements

The certificate is awarded after the completion of all quizzes. The participants must attain a minimum of 75 percent in the program. The entire course is comparable to 72 classroom hours of instruction and assessment**.** Therefore, the certificate will state that the recipient has earned 7.2 Continuing Education Units (CEUs) or 72 Professional Development Hours (PDHs). However, the course does not carry any college credits and cannot be used as part of a degree-seeking program.

Course Delivery

Each class is delivered as recorded webinars so attendees can view classes any time they wish. Class handouts and quizzes are also available on the University of Kansas Blackboard learning management system. Attendees will receive an ID and password to enter the site. Study material consists of the assigned online notes for a particular session. There is no text for this class.

Instructor Availability

While you are enrolled in the course, you can email the instructor with any questions that you have. He will reply within 2 business days.

Instructor

Moe Toghraei has a Bachelor of Science degree in chemical engineering (1990) and a Master of Science in environmental engineering (1998). He is also a Licensed Professional Engineer. Moe has more than 20 years' experience working in different process industries, including oil upstream, refinery, petrochemical complex, water and wastewater treatment (municipal and industrial), and even food industries. He worked in different phases of projects, including design (basic engineering and detailed engineering), construction, pre-commissioning and commissioning, start-up, and operation. He is now working as an independent consultant and is also providing training courses in the process engineering areas.

Refund and Cancellation Policy

No refunds will be granted for this class once the student has accessed the Blackboard class site. A full refund of registration fees, less a $30 administrative fee, will be approved if requested in writing prior to accessing the course. Requests must be made within 60 days of payment. The cost of any text or course materials you have received will also be withheld from your refund.