COURSE OVERVIEW IE0582

Instrumentation E-Learning Module

Process Control & Instrumentation

Course Title

Instrumentation E-Learning Module: *Process Control & Instrumentation*

Course Reference

IE0582

Course Format & Compatibility

SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration

30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description

Process control is becoming an increasingly important engineering topic, since the subject plays a crucial role in the design, operation and maintenance in areas such as power plants and chemical and industrial process plants. Control systems have advanced dramatically during the last decade. They become more modular and more sophisticated offering a vast variety of control functions for all the systems that operate within a modern "intelligent" facility. Enhanced functionality of the automation systems also means more complexity, interactive strategies, new technologies and systems management with resulting better control and improved reliability.

This E-Learning course is designed to provide participants with a detailed and up-to-date overview of process control and instrumentation. It covers the P&ID symbols, typical applications, basic control concepts, basic control theory, pressure measurement and basic principles; the pressure elements, spring and bellows elements, diaphragm elements, pressure transducers and strain gauges; the vibrating wire, piezoelectric, capacitance, installation considerations and future technologies; and the temperature measurement, resistance temperature detectors, thermistors, non-contact measurement, infra-red measurement, radiation pyrometry and installation considerations.

During this interactive course, participants will learn the level measurement, ultrasonic level measurement, radar level measurement, radiation level measurement and electrical level measurement; the typical tank level installations, flow measurement, installation considerations and selection guidelines; the various types of control valves and implement control valve selection, smart field measurement, calibration and commissioning; the system components, SCADA systems, levels of hierarchy, modes of control and stability; the tuning methods, ratio control, cascade control, flow control, level control, pressure control and temperature control; and the measurement technology, multi - variable transmitter, wireless transmitter, digital positioners, control system technology, communication technology and ethernet.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on process control and instrumentation
- Discuss P&ID symbols, typical applications, basic control concepts, basic control theory, pressure measurement and basic principles
- Recognize pressure elements, spring and bellows elements, diaphragm elements, pressure transducers and strain gauges
- Explain vibrating wire, piezoelectric, capacitance, installation considerations and future technologies
- Carryout temperature measurement, resistance temperature detectors, thermistors, non-contact measurement, infra-red measurement, radiation pyrometry and installation considerations
- Employ level measurement, ultrasonic level measurement, radar level measurement, radiation level measurement and electrical level measurement
- Apply typical tank level installations, flow measurement, installation considerations and selection guidelines
- Identify the various types of control valves and implement control valve selection, smart field measurement, calibration and commissioning
- Recognize system components, SCADA systems, levels of hierarchy, modes of control and stability
- Illustrate tuning methods, ratio control, cascade control, flow control, level control, pressure control and temperature control
- Discuss measurement technology, multi - variable transmitter, wireless transmitter, digital positioners, control system technology, communication technology and ethernet

Who Should Attend

This course provides an overview for all significant aspects and considerations of process control for process control engineers and supervisors, instrumentation and control system engineers, automation engineers, instrumentation engineers and technologists. Further, process engineers, electrical engineers and supervisors and those involved in the design, implementation and upgrading of industrial control systems will also benefit from the practical aspects of this course.

Course Certificate(s)
Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations
Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 1-2013 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 1-2013 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Association for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Fee
As per proposal

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Contents

- Introduction
- Theory & Application
- Control History
- Basic Measurement Definitions
- P & ID Symbols
- Typical Applications
- Basic Control Concepts
- Basic Control Theory
- Pressure Measurement
- Basic Principles
- Definition of Terminology
- Pressure Elements - Mechanical
- Bourdon Tubes
- Spring and Bellows Elements
- Diaphragm Elements
- Pressure Transducers - Electrical
- Strain Gauges
- Vibrating Wire
- Piezoelectric

- Capacitance
- Illustration of a Capacitance D.P. Meter body
- Diagram of a Capacitance D.P. Meter body
- Installation Considerations
- Future Technologies
- Course Recap
- Temperature Measurement
- Principles
- Thermocouples
- Resistance Temperature Detectors
- Thermistors
- Non-Contact Measurement
- Infra-Red Measurement
- Radiation Pyrometry
- Installation Considerations
- Impact on Overall Loop
- Future Technologies
- Course Recap
- Level Measurement
- Main Types
- Buoyancy Tape Systems
- Hydrostatic Pressure
- Ultrasonic Level Measurement
- Radar Level Measurement
- Vibrating Switches
- Radiation Level Measurement
- Electrical Level Measurement
- Installation Considerations
- Typical Tank Level Installations
- Installation Considerations
- Impact on Overall Loop
- Future Technologies
- Flow Measurement

- Principles of Flow Measurement
- Differential Pressure Flow Measurement
- Basic Flow Theory
- Differential Pressure Flowmeters
- Basic Principles
- Oscillatory Flow Measurement
- Non-intrusive Flow Measurement
- Mass Flow Measurement
- Positive Displacement Flow Measurement
- Installation Considerations
- Selection Guidelines
- Future Technologies
- Course Recap
- Types of Control Valves
- Rotary Valves
- Butterfly Valves
- Eccentric Disk Valves
- Eccentric Rotary Plug Valves
- Ball Valves
- Plug Valves
- Linear Valves
- Globe Valves
- Hygienic Applications
- Cage Valves
- Diaphragm Valves
- Pinch Valves
- Break
- Control Valve Selection
- Price Comparison
- Decision Criteria
- Selection Guidelines
- Application Comparisons
- Leakage Rates

- Valve Characteristics
- Application Examples
- Turndown Vs Rangeability
- Actuator Selection
- Types of Actuators
- Electric
- Hydraulic
- Pneumatic
- Linear Actuators
- Rotary Actuators
- Actuator Forces
- Positioners
- Fail Safe Actuators
- Basic Control Concepts
- Introduction
- Variables
- Basic Elements
- Manual Control
- Feedback Control
- System Responses
- On – Off Control
- Three Term Control
- Proportional Only Control
- Proportional plus Integral Control
- Proportional plus Integral Plus Derivative Control
- Digital Field Communications
- Data Highway
- Fieldbus Communications
- Advantages of Fieldbus
- Fieldbus Technologies
- HART
- Foundation Fieldbus
- ProfiBus

- Course Recap
- Smart Field Measurement
- Smart Sensor Basics
- A Smart Transmitter
- Brief Specification
- Overview
- Calibration
- Square Root Extraction
- Zero and Span Adjustment
- Commissioning
- Wiring Detail
- Multi-Dropping
- Distributed Control Systems
- Introduction
- Traditional Process Controllers
- DCS Hardware & Software
- Architecture of Controllers
- Software
- Programming
- Execution Time
- Organizing Execution Time for Control Action
- Programming Vs. Configuration
- Function Blocks
- Object-orientated
- Soft-wiring
- Analogue vs. Microprocessor
- Connections to the Controller
- Programmable Logic Controllers
- Introduction
- History
- Today's Position
- Principles of Operation
- System Components

- Functional Interaction of a PLC System
- Input/Output Interfaces
- Configuration
- Course Recap
- SCADA Systems
- Basic Definitions
- Levels of Hierarchy
- 1. Field Level and Instrumentation Devices
- 2. Remote Terminal Units
- 3. Communications System
- 4. Master Stations
- 5. Management Level
- SCADA Configuration
- Course Recap
- Modes of Control
- Stability
- Stability of the Feedback Loop
- Ultimate Gain
- Determining the Ultimate Gain and Period
- Tuning Methods
- Tuning for Quarter Decay Response
- Ratio Control
- Cascade Control
- Application Examples
- Flow Control
- Level & Pressure Control
- Temperature Control
- Course Recap
- New Trends
- Measurement Technology
- Multi - Variable Transmitter
- Wireless Transmitter
- Digital Positioners

- 3 Beam Ultrasonic Flowmeter
- Control System Technology
- Communication Technology
- Ethernet