



COURSE OVERVIEW IE0629

**Process Measurement, Instrumentation & Process Control
(E-Learning Module)**

Course Title

Process Measurement, Instrumentation & Process Control (E-Learning Module)

Course Reference

IE0629

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



This E-Learning course is designed to provide participants with a detailed and up-to-date overview of process measurement, instrumentation and process control. It covers the process control and instrumentation theory and application; the basic measurement definitions, range of operations, typical applications and basic control concepts; the basic control theory, basic principles and definition of terminology; the bourdon tubes advantages and disadvantages; the spring and bellows elements; the application limitations, diaphragm elements and diaphragm sensors; the pressure transducers, strain gauges, vibrating wire and piezoelectric; the installation considerations, temperature measurement, principles, thermocouples and resistance temperature detectors; and the non-contact measurement, infrared measurement, radiation pyrometry and non-contact pyrometers.

Further, the course will also discuss the impact on overall loop and future technologies; the level measurement, ultrasonic level measurement, radiation level measurement, radar measurement, electrical level measurement and flow measurement; the principles of flow measurement and basic flow theory; and the oscillatory flow measurement, non-intrusive flow measurement, mass flow measurement, and positive displacement flow measurement.



During this course, participants will learn the flowmeter selection process, types of control valves including rotary valves, butterfly valves, eccentric disk valves, eccentric rotary plug valves, and etc.; the control valve, actuator selection and types; and the probable causes of failure in field equipment and the general requirements for fail safe operations.

Course Objectives

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

- Apply and gain an in-depth knowledge on process measurement, instrumentation and process control
- Discuss process control and instrumentation including theory and application
- Illustrate the basic measurement definitions, range of operations, typical applications and basic control concepts
- Explain basic control theory, basic principles and definition of terminology
- Identify bourdon tubes advantages and disadvantages including spring and bellows elements
- Determine application limitations, diaphragm elements and diaphragm sensors
- Recognize pressure transducers, strain gauges, vibrating wire and piezoelectric
- Discuss installation considerations, temperature measurement, principles, thermocouples and resistance temperature detectors
- Review non-contact measurement, infrared measurement, radiation pyrometry and non-contact pyrometers
- Determine impact on overall loop and future technologies
- Carryout level measurement, ultrasonic level measurement, radiation level measurement, radar measurement, electrical level measurement and flow measurement
- Discuss the principles of flow measurement and basic flow theory
- Employ oscillatory flow measurement, non-intrusive flow measurement, mass flow measurement, and positive displacement flow measurement
- Describe flowmeter selection process, types of control valves including rotary valves, butterfly valves, eccentric disk valves, eccentric rotary plug valves, and etc.
- Carryout control valve and actuator selection as well as identify their types
- Determine the probable causes of failure in field equipment and the general requirements for fail safe operations

Who Should Attend

This course covers systematic techniques on process measurement, instrumentation and process control for those who are involved in the operations function and who are responsible for leading and directing people to achieve and improve productivity levels. Those faced with the challenge of actually using the various techniques of troubleshooting and problem solving to reduce downtime and waste the improve run efficiencies will benefit.




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: -

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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.

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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

- Process Control & Instrumentation
- Introduction
- Theory & Application
- Topics
- Control History
- Basic Measurement Definitions
- Accuracy
- Range of Operations
- Linearity
- Repeatability
- Response
- P & ID Symbols
- Typical Applications
- APPLICATIONS
- Basic Control Concepts
- BASIC CONTROL THEORY
- Review Questions
- Pressure Measurement
- Basic Principles
- Definition of Terminology

- Pressure Elements - Mechanical
- Bourdon Tubes
- Bourdon Tube - Advantages
- Bourdon Tube - Disadvantages
- Spring and Bellows Elements
- Low Pressure Spring & Bellows Element
- Spring & Bellows Elements
- Diaphragm, Bellows and Piston
- Advantages - Spring/Bellows
- Disadvantages - Spring/Bellows
- Application Limitations
- Diaphragm Elements
- Diaphragm Sensors
- Advantages - Diaphragm
- Pressure Transducers Electrical
- PRESSURE TRANSDUCERS
- Strain Gauges
- Vibrating Wire
- Piezoelectric
- Advantages
- Disadvantages
- Capacitance
- Advantages
- Disadvantages
- Installation Considerations
- COURSE RECAP
- Temperature Measurement
- Principles
- Thermocouples
- RESISTANCE TEMPERATURE DETECTORS
- THERMISTORS
- Non-Contact Measurement
- Infra Red Measurement
- Radiation Pyrometry
- NON-CONTACT PYROMETERS

- Impact on Overall Loop
- Future Technologies
- COURSE RECAP
- Level Measurement
- Main Types
- Buoyancy Tape Systems
- HYDROSTATIC PRESSURE
- Ultrasonic Level Measurement
- Radar Level Measurement
- RADAR MEASUREMENT
- Vibrating Switches
- Radiation Level Measurement
- Electrical Level Measurement
- TYPICAL TANK LEVEL INSTALLATIONS
- IMPACT ON OVERALL LOOP
- Flow Measurement
- Principles of Flow Measurement
- BASIC FLOW THEORY
- DIFFERENTIAL PRESSURE FLOWMETERS
- Oscillatory Flow Measurement
- Non-Intrusive Flow Measurement
- Mass Flow Measurement
- MASS FLOW
- POSITIVE DISPLACEMENT FLOW MEASUREMENT
- POSITIVE DISPLACEMENT
- Selection Guidelines
- Flowmeter Selection process
- COURSE RECAP
- Review Questions
- Types of Control Valves
- MAIN TYPES
- Rotary Valves
- Butterfly Valves
- Eccentric Disk Valves
- Eccentric Rotary Plug Valves

- ROTARY PLUG VALVES
- Ball Valves
- Soft Seated
- Metal Seated
- PLUG VALVES
- Linear Valves
- Globe Valves
- HYGENIC APPLICATIONS
- CAGE VALVES
- Diaphragm Valves
- Pinch Valves
- Break
- Control Valve Selection
- Price Comparison
- Decision Criteria
- HOW TO CHOOSE THE RIGHT VALVE
- Selection Guidelines
- CONTROL VALVE SELECTION
- Application Comparisons
- Leakage Rates
- Valve Characteristics
- CAGE GUIDED GLOBE
- VALVE CHARACTERISTICS
- Application Examples
- Turndown Vs Rangeability
- TURNDOWN / RANGEABILITY
- Review Questions
- Actuator Selection
- Types of Actuators
- Electric
- Hydraulic
- Pneumatic
- Linear Actuators
- Rotary Actuators
- ACTUATOR FORCES

- Globe Valve Actuator Sizing
- 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 Derivative Control
- Proportional plus Integral plus Derivative Control
- Review Questions
- Selecting Sensors and Final Elements
- Introduction
- Non-Essential Components
- Certified or Proven
- PROBABLE CAUSES OF FAILURE IN FIELD EQUIPMENT
- Smart Field Instruments
- DIGITAL VALVE CONTROLLER
- General Requirements For Fail Safe Operations
- Selecting Sensors and Final Elements
- Review Questions
- Digital Field Communications
- Data Highway
- Fieldbus Communications
- Advantages of Fieldbus
- FIELDBUS TECHNOLOGIES
- HART
- COURSE RECAP
- Review Questions

- Smart Field Measurement
- Smart DP Transmitter
- Smart Sensor Basics
- A Smart Transmitter
- Brief Specification
- Overview
- Calibration
- Commissioning
- Wiring Detail
- Review Questions
- 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
- Review Questions
- Programmable Logic Controllers
- Introduction
- HISTORY
- Today's Position
- Principles of Operation
- System Components
- Input/Output Interfaces
- Configuration
- COURSE RECAP

- Review Questions
- SCADA Systems
- Basic Definitions
- Levels of Hierarchy
- Field Level and Instrumentation Devices
- Remote Terminal Units
- Communication Systems
- Master Stations
- Management Level
- SCADA CONFIGURATION
- COURSE RECAP
- Review Questions
- Safety Instrumented Systems
- Preview
- Concept
- Safety Instrumented Functions (SIF)
- Safety Instrumented Systems (SIS)
- Safety Integrity Level (SIL)
- Hazard and Risk Analysis
- Safety Functions
- Safety PLC
- Safety Integration
- General Notes
- Course Recap
- Review Questions