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Instrumentation & Controls

Instrumentation & Control Systems for Industrial Machinery

Course Introduction

In today's modern industrial plant, continuous machine monitoring is an essential requirement in terms of protecting personnel, protecting the environment and protecting the plant equipment itself.

Machine monitoring encompasses a wide range of technologies: ranging from supervisory control interlocking and sequential control implemented through the programmable logic controller; closed loop digital control; and modern Smart instrumentation. Machine monitoring not only encompasses the conventional measurement of pressure and temperature but also less well known measurements including vibration, thermography, tribology, and analytical xerography.

This workshop, PRACTICAL Instrumentation and Control Systems for Industrial Machinery, is designed to provide engineers and technicians with the basic theoretical and practical understanding of a wide range of modern technologies and how these can be applied to optimize their systems in terms of safety, flexibility and costs.

Target Audience

- Control & Instrumentation Engineer
- Controls Technologist
- Instrumentation Technician / Systems Control Tech
- Senior Control & Instrumentation Engineer
- Maintaining Equipment Engineer
- Facilities I&E / Controls Engineer
- Offshore Instrumentation Engineer

Learning Objectives

- Recognize the impact of modern Instrumentation
- Appreciate major Technologies used in the Measurement ofTemperature and Pressure
- Evaluate and select the appropriate Instrumentation System
- Install process Equipment correctly
- Understand the fundamentals of Process Control
- Fully comprehend the effects of proportional, integral andderivative control
- Recognize the effect of different Control Algorithms onLoop Tuning Performance
- Understand basic serial Communications
- Appreciate the role of the final Control Element in a ControlLoop
- Predict cavitation and flashing Pick the Optimum Valve andActuator Combination
- Avoid incorrect Valve and Actuator Installation Practices
- Appreciate the differences between Inherent and installedCharacteristics
- Pick the Optimum Valve-Actuator Combination
- Understand Potential Failure Analysis and the PFA tree
- Value the principles of Risk Analysis

Course Outline

- **01 Day One**

  Module (01) Smart Instrumentation

    - 1.1 Temperature
    - 1.1.1 Basic principles
    - 1.1.2 Scales
    - 1.1.3 Expansion systems
    - 1.1.4 Thermocouples
    - 1.1.5 Resistance thermometry
    - 1.1.6 Thermistors
    - 1.1.7 Radiation thermometry

- 1.1.8 Thermal imaging
- 1.1.9 Installation considerations
- 1.2 Pressure
- 1.2.1 Basic principles
- 1.2.2 Bourdon tubes
- 1.2.3 Bellow elements
- 1.2.4 Diaphragm elements
- 1.2.5 Electrical displacement sensors
- 1.2.6 Digital communications & HART protocol

• **02 Day Two**

Module (02) Digital Control

- 2.1 ON/OFF control
- 2.2 Proportional control
- 2.3 Proportional band vs. proportional gain
- 2.4 Proportional offset
- 2.5 Reset
- 2.6 Integral action
- 2.7 Integral windup
- 2.8 Stability
- 2.9 Bode plot
- 2.10 NYQUIST plot
- 2.11 Derivative action
- 2.12 PID control
- 2.13 Control algorithms
- 2.14 Load disturbances and offset
- 2.15 Speed, stability and robustness
- 2.16 Basic principles of tuning
- 2.17 Open loop reaction curve method (Ziegler-Nichols)
- 2.18 Default and typical settings
- 2.19 Closed loop continuous cycling method (Ziegler-Nichols)
- 2.20 Fine tuning
- 2.21 Tuning for different applications

• **03 Day Three**

Module (03) PLCs and SCADA Systems

- 3.1 Fundamentals principles
- 3.2 CPU
- 3.3 Memory
- 3.4 Digital I/O modules
- 3.5 Analog I/O modules
- 3.6 PLC programming
- 3.7 Analog control
- 3.8 SCADA systems
- 3.9 Field level Instrumentation and control
- 3.10 Communication Systems

• **04 Day Four**

Module (04) Control Valves and Actuators

- 4.1 Basic theory
- 4.2 Choked flow
- 4.3 Flashing and cavitation
- 4.4 Valve design
- 4.5 Control valve characterization
- 4.6 Actuators
- 4.7 Positioners
- 4.8 Valve testing
- 4.9 Calibration

• **05 Day Five**

Module (05) Predictive Maintenance

- 5.1 Potential Failure Analysis (PFA tree)
- 5.2 Fault mechanism analysis (FMEA and FMECA)
- 5.3 Risk analysis
- 5.4 Maintenance Strategies
- 5.5 Predictive maintenance technologies
- 5.6 Thermography,
- 5.7 Tribology
- 5.8 Vibration Analysis
- 5.9 Analytical xerography

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
June 16, 2025	June 20, 2025	5 days	4250.00 $	UAE - Dubai
Sept. 8, 2025	Sept. 12, 2025	5 days	4950.00 $	Ireland - Galway
Nov. 2, 2025	Nov. 6, 2025	5 days	4250.00 $	KSA - Jeddah