

# GULF INSTITUTE



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# Industrial Instrumentation and Modern Control Systems

## INTRODUCTION

- Instrumentation can be viewed as the eyes and the ears of the operator in the modern plant. They are there to collect information, and to assist the operator in analysing current plant conditions. The operator is then better equipped to make the necessary decisions, pertaining to better control of the plant. Of course, not all of the control decisions falling to the domain of the plant operator. Many processes are automated. In the past, excellent analogue equipment was available to do the control function. In the current digital world, modern control systems have come to the fore. These include model based control equipment.
- This Industrial Instrumentation and Modern Control Systems training course combines all of this, into one powerful, high impact, week of learning. The workshop starts off discussing aspects of transmitters, along with the modern choice of fieldbus and HART and other communication aspects. It then delves into final control elements (many of them adjustable). This is followed by important aspects of pressure, level, temperature and flow. The workshop then moves into process control and loop tuning, ending off with model-based control systems, and how this fits into the modern notion of process control.

Participants attending the Industrial Instrumentation and Modern Control Systems training course will develop the following competencies:

- Be able to work with and convert modern instrumentation signals
- The cognitive ability to implement a modern network-based system
- Comprehensive understanding of PID control
- Effective tuning of most modern control loops
- Implement a model-based control system
- Effectively deal with large dead times

## PROGRAMME OBJECTIVES

Industrial Instrumentation and Modern Control Systems training course aims to help participants to achieve the following objectives:

- Define the role and objectives of instrumentation in any plant
- Understand the importance of process variables, in process control
- Develop their skills in selecting the right transmitter for an application
- Improve their skills process control strategies
- Correctly implement loop tuning strategies (using numerous methodologies)
- Understand the concept of model-based control
- Comprehend the intricacies of IMC and MPC strategies

## WHO SHOULD ATTEND?

This Industrial Instrumentation and Modern Control Systems training course is suitable for a wide range of professionals employed in Engineering, but it will be particularly beneficial to:

- Plant Management Personnel
- Engineers from all disciplines
- Processing Control Technicians
- Instrumentation Artisans
- Supervisors
- People involved in Projects
- People dealing with Instrumentation Equipment Selection
- Representatives from the Safety Department
- Representatives from Purchasing Departments
- Anyone with more than just a passing interest in instrumentation

## TRAINING METHODOLOGY

- This Industrial Instrumentation and Modern Control Systems training course will combine presentations with instructor-guided interactive discussions between participants relating to their individual workplace. Practical exercises, video material and case studies aiming at stimulating these discussions and providing maximum benefit to the participants will support the training. Where applicable, computer simulators will also be used.

## PROGRAMME SUMMARY

- This unique training course on Industrial Instrumentation and Modern Control Systems covers critical areas of instrumentation and process control. Participants will acquire and develop essential skills that will improve their technical competence while at the same time improving the overall PV driven processes that are there to ensure best plant operation.

## Programme Outline

### Introduction to Process Variable Measurement

- Sensors, Transducers and Instrumentation Systems
- Instrumentation Signals
- Instrumentation Terms and Definitions
- HART Protocol
- Fieldbus
- Digital Communication and Techniques
- A quick introduction to final control elements (including control valves, VSD and VFD)

## Pressure, Level, Temperature, and Flow Measurement

- Pressure Measurement – principle of operation, devices, typical uses and installation considerations
- Level Measurement – principle of operation, devices, typical uses and installation considerations
- Temperature Measurement – principle of operation, devices, typical uses and installation considerations
- Flow Measurement – principle of operation, devices, typical uses and installation considerations

## Process Control

- Process Dynamics
- Process Stability
- Process Responses
- Types of control that may be implemented
- The P part of PID Control
- The I part of PID Control
- The D part of PID Control
- Cascade Control

## Advanced Control and Loop Tuning Strategies using Digital Controllers

- Ratio control
- Combined feed forward and feedback control
- Open loop tuning methods, using formulae
- Closed loop tuning methods, using formulae
- Open loop tuning, using trial and error
- Closed loop tuning, using trial and error
- Dealing with processes that have large dead time

## Model-Based Control, where a PID Controller isn't the Preferred Option

- Using a model-based controller
- Using a Smith Predictor

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