



**Training Program:**  
**INDUSTRIAL INSTRUMENTAION AND MODERN CONTROL  
SYSTEMS Selection. Applications. Operation and  
Diagnostics**

# INTRODUCTION

This seminar will provide a comprehensive understanding of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology. This seminar will focus on maximizing the efficiency, reliability, and longevity of these systems and equipment by providing an understanding of the characteristics, selection criteria, common problems and repair techniques, preventive and predictive maintenance.

This seminar is a MUST for anyone who is involved in the selection, applications, or maintenance of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology because it covers how these systems and equipment operate, the latest maintenance techniques, and provides guidelines and rules that ensure their successful operation. In addition, this seminar will cover in detail the basic design, operating characteristics, specification, selection criteria, advanced fault detection techniques, critical components and all preventive and predictive maintenance methods in order to increase the reliability of these systems and equipment and reduce their operation and maintenance cost

This seminar will provide the following information for modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology:

- Basic Design
- Specification
- Selection Criteria
- Sizing Calculations
- Enclosures and Sealing Arrangements
- Codes and Standards
- Common Operational Problems
- All Diagnostics, Troubleshooting, Testing, and Maintenance

## WHO SHOULD ATTEND ?

- Engineers of all disciplines
- Managers
- Technicians
- Maintenance personnel
- Other technical individuals

## CERTIFICATE

BTS attendance certificate will be issued to all attendees completing minimum of 80% of the total course duration.

## TRAINING METHODOLOGY

The instructor relies on a highly interactive training method to enhance the learning process. This method ensures that all the delegates gain a complete understanding of all the topics covered. The training environment is highly stimulating, challenging, and effective because the participants will learn by case studies which will allow them to apply the material taught to their own organization.

## SPECIAL FEATURE

Each delegate will receive a copy of the following material written by the instructor:

- Practical manual (400 pages)

# SEMINAR OUTCOME

- **Equipment Operation:** Gain a thorough understanding of the operating characteristics of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Diagnostics and Inspection:** Learn in detail all the diagnostic techniques and inspections required of critical components of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Testing:** Understand thoroughly all the tests required for the various types of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Maintenance and Troubleshooting:** Determine all the maintenance and troubleshooting activities required to minimize the downtime and operating cost of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Repair and Refurbishment:** Gain a detailed understanding of the various methods used to repair and refurbish modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Efficiency, Reliability, and Longevity:** Learn the various methods used to maximize the efficiency, reliability, and longevity of modern control systems, digital control,

distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology

- **Equipment Sizing:** Gain a detailed understanding of all the calculations and sizing techniques used for modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Design Features:** Understand all the design features that improve the efficiency and reliability of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Selection:** Learn how to select modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology by using the performance characteristics and selection criteria that you will learn in this seminar
- **Equipment Enclosures and Sealing Methods** Learn about the various types of enclosures and sealing arrangements used for modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Commissioning:** Understand all the commissioning requirements for modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Codes and Standards:** Learn all the codes and standards applicable for modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology
- **Equipment Causes and Modes of Failure:** Understand the causes and modes of failure of modern control systems, digital control, distributed control systems (DCSs),

supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology

- **System Design:** Learn all the requirements for designing different types of modern control systems, digital control, distributed control systems (DCSs), supervisory control and data acquisition (SCADA) systems, industrial instrumentation, control valves, actuators, and smart technology

## COURSE OUTLINE

### Day 1 - Feedback Control and Proportional-Integral-Derivative Algorithm

- Introduction to Feedback Control Systems
- Process and Instrument Elements of the Feedback Loop
- Control Performance Measures
- Integral Error Measures, Decay ratio, Period of Oscillation, Manipulated-Variable Overshoot
- Selection of Variables for Control
- Feedback Control Algorithm
- Proportional Control
- Integral Control
- Derivative Control
- Proportional-Integral-Derivative Controller

### Day 2 - Proportional-Integral-Derivative Controller Tuning for Dynamic Performance

- Determining Tuning Constants that Give Good Control Performance
- Controlled-Variable Performance (Integral Absolute Error)
- Good Control Performance with Model Errors
- Manipulated-Variable Behavior
- Correlations for Tuning Constants
- Fine-Tuning the Controller

- Stability of Control Systems
- Controller-Tuning Based on Stability
- Effect of Process Dynamics on Tuning
- Types of Control Systems
- Continuous and Discrete Data Control Systems
- Cascade Control Systems

### **Day 3 - Distributed Control Systems (DCS)**

- Structure of the Distributed Control System (DCS)
- Discrete Proportionl-Integral-Derivative (PID) Control Algorithm
- Effect of Digital Control on Stability
- Tuning and Performance
- Smart Sensors
- Controller Algorithms
- Monitoring and optimization
- Distributed Control System (DCS) Architecture and Advantages

### **Day 4 - Distributed Control Systems (DCS) Components and Features, Supervisory Control and Data Acquisition (SCADA) System, and Intelligent (Smart) Transmitters**

- Distributed Control Systems Components and Features
- Supervisory Control and Data Acquisition (SCADA) System
- Advantages of Distributed Control System (DCS)
- Microprocessors and Microcomputers
- Microprocessor Architecture
- Microcomputer System
- Smart Systems
- Intelligent (Smart) Transmitters
- Microprocessor-Based Transmitters (Smart Transmitters)
- Smart (Intelligent) Pressure Transmitters
- Advantages of Intelligent Instrumentation



- Comparison Between Intelligent and Non-Intelligent Instrumentation
- Stand-Alone Controllers
- Self-Tuning, Sequencing, and Networking
- HART Protocol

#### **Day 5 - Control Valves and Actuators**

- General Categories of Control Valves
- Rangeability, End Connections, Shutoff Capability
- Valve Sizing
- Choked Flow
- Gas and Steam Sizing
- Control Valve Sizing and selection
- Control Valve Cavitation
- Control Valve Noise
- Pneumatic of Actuators
- Piston Actuators
- Electric Actuators
- Hydraulic Actuators
- Positioners
- Live Loading
- Diagnostic Testing of Control Loops
- Air-Operated Valves Diagnostics
- Motors-Operated Valves Diagnostics