

## INSTART Online Instrumentation and Control Course

Dear Sir/Madam,

Warm greetings from **INSTART Team**. By this means, we proudly present our **90-hour Online Instrumentation and Control Training Course** details to those who seek a career in Instrumentation & Control Engineering. This training course not only provides introductions to instrumentation engineering in industries such as Oil and Gas, Chemicals, Steel, and Mine but also makes you understand the idea of instrumentation & control engineering design concepts like Instrument Selection & Sizing, Calibrating, Documentation, Instruments deliverables, Project specifications, International Standards, etc.

### **Prerequisites of Candidate:**

Should have a Diploma or a Higher Degree in Instrumentation/Control Systems/Electronics/Electrical Engineering or at least some basic knowledge in Instrumentation.

Below, we have provided A brief description of topics covered in this course for your reference:

### **1. Standards, Materials, Definitions, and Connections**

- Standards
- API
- ISA
- BS
- ASME
- ANSI
- ASTM
- NACE
- EN
- NFPA
- Non-Metallic Material (PTFE, GRP, PE, etc.)
- Metallic Material (Carbon Steel, Stainless Steel, Monel, Inconel, etc.)
- Cast
- Forge
- Gauge
- Transmitter
- Switch
- Signals
- Power Supply
- Connections
- Related Pictures and Videos

### **2. Pressure**

- Pressure Measuring
- Pressure Gauge
- Design a proper Pressure Gauge
- Connection

- Socket Material
- Window (Safety Glass)
- How to Calibrate a Pressure Gauge
- Dead Weight Tester
- Range (Pressure Gauge)
- Solid Front Gauges
- Accessories of a Pressure Gauge
- 2-Way Valve Manifold
- Syphon
- Diaphragm Seal
- Cooling Element
- Pulsation Damper
- Snubber
- Over range Protector
- Element (Sensors) for a Pressure Gauge
- Bourdon Tube Sensors
- Manometer
- Pressure Measurement Methods
- Pressure Gauge & Calibration Devices
- Capsule Pressure Gauge
- Pressure Transmitters
- HART Protocol
- How to Calibrate a Pressure Transmitter
- Pressure Transmitter Measuring Sensors
- Accessories of a Pressure Transmitter
- Related Pictures and Videos
- Datasheet of Pressure Instruments
- **Pressure Workshop**

### 3. Temperature

- Temperature Gauge
- Bi-metal Sensor
- Design of a Temperature Gauge
- Thermowell
- Installation on an Elbow
- Thermowell Shapes Based on different types of Construction or Shank
- Suitable Material for Construction
- How to choose and design a proper Thermowell
- Temperature Transmitters with Local indicator (Receiver)
- Crucial parameters to choose and design a Temperature Transmitter
- Temperature Transmitter Elements
- Thermocouple
- PTC/NTC Sensors
- Measuring Range of Sensors

- H.J and C.J Connections
- Cold Junction Compensation (CJC)
- Thermocouple Cables
- Single and Dual Sensors
- Signal rate in Case of Failure (Burnout Protection)
- How to Calibrate a Temperature Sensor
- Oven
- Reference Instrument
- Problems in Installation
- Ungrounded/Grounded/Exposed Thermocouple
- Related Pictures and Videos
- Datasheet for Temperature Instruments
- **Temperature Workshop**

#### 4. Flow

- Basic Concepts
- Theory of Flow
- Volumetric and Mass Flow
- Reynolds Number
- Turn Down Ratio (Rangeability)
- Repeatability
- Different Flow Profiles
- Normalized Flow
- How to Calculate Flow based on Velocity and Differential Pressure
- Specific Gravity
- Venturi Tube
- Orifice Plate
- Beta-Ratio
- Upstream and Downstream length for Flow Elements Installation
- Flow Nozzle
- Pitot Tube
- Annubar
- Target Meter
- Turbine Flowmeter
- Magnetic Type Flowmeter
- Ultrasonic Flowmeter (Time Transit and Doppler)
- Clamp-on & In-line Ultrasonic Flowmeters
- Vortex Flowmeter
- Variable Area Flowmeter (Rotameter)
- Proximity Switch
- Reed Switch
- Mass Flowmeter (Coriolis)
- Thermal Mass Flowmeter
- Positive Displacement

- Metering System (Custody Transferring System)
- Flow Compensation
- Level of Stability in Metering System
- Provers
- Comparison of different types of Flowmeters
- Related Pictures and Videos
- Datasheet of Flow Instruments
- Calculation of an Orifice plate with software according to ISO5167
- **Flow Workshop**

## 5. Level

- Level Measurement
- Related Standards
- Servo Type Level Gauge
- Sight Glass (Level Gauge)
- Usage of a Stand – Pipe
- Different types of Sight Glasses
- Tubular
- Reflex
- Transparent
- Magnetic
- How to design a Level Gauge on a Drum (Vessel)
- Hydrostatic Pressure
- Bubble Type
- Differential Pressure Transmitter
- Wet Leg and Dry Leg
- Condensate Pot (Steam Trap)
- How to Calibrate a D/P Level Transmitter
- Zero & Span
- Displacer Level Meter
- Archimedes Buoyancy Rule
- Practical example (3-phase separator)
- How to Calibrate a Displacer Level Transmitter
- Capacitive Level Meter
- Ultrasonic Level Transmitter
- Blocking Distance (Blind Zone)
- Radar Level Transmitter
- Antenna Shapes of Radar
- FMCW / Pulse Radar
- Nuclear Level Meter
- Servo Type Level Meter (Transmitter)
- Tank Gauging System
- Level Switches
- Bi-morph Drive

- Stack Drive
- Electrical Contacts
- Related Pictures and Videos
- Datasheet of Level Gauge
- Datasheet for Ultrasonic Level transmitter
- **Level Workshop**

## 6. Hook-up

- Hook-up
- Designing of Hook-up Drawings
- Introduction to different types of Connectors, Couplings, and Fittings (Plug, Nipple, Reducer, Swage, Valve, Tee, Elbow, Tube, Union, etc.)
- Different Standards of Thread Connections
- Hook-up & Installation
- Hook-up for Pressure Gauge
- Hook-up for Pressure Transmitter
- Hook-up for Differential Pressure Transmitter

## 7. P&ID Survey

- P&ID
- Symbols and Legends
- Line Class (PMS)
- Abbreviations
- Pump Equipment
- Close and Open Loops
- Logics and Interlocks
- Electrical and Pneumatic Signals
- ESD/DCS Signals
- Survey a Project P&ID according to ISA S5.1

## 8. Control Valve

- Industrial Valves
- Control Valve in a P&ID
- Fail Explanation
- Control Valve Different Signals
- LCP/Pneumatic Panel
- Different types of Control Valves
- Control Valves Standards
- Control Valve Definitions
- Valve Coefficient (Cv)
- Half Stroke Time
- Stroking Time
- FTO / FTC
- Severe Services (Cavitation, Flashing, Choked Flow, Noise)

- Low Recovery & High Recovery Valves
- Globe Valve
- Globe Valve different parts (Internal and External)
- Different Port Shapes
- Single & Double Ports
- Different seat
- Balanced & Unbalanced Plugs
- Stellite Material
- Valve Trim
- Different Bonnets
- Packing
- Valve Characteristics
- Cage
- Solutions for severe services
- Noise Treatments
- Actuators
- How to design a Proper Actuator
- Different types of Actuators (Manual and Automatic)
- Single / Double acting
- Diaphragm Actuators
- Piston type Actuators
- Motorized Operated valve (MOV)
- Solenoid Valve
- Air set & Positioner
- Different parts of Positioner
- How to Calibrate a positioner
- How to install a Positioner and Actuator on a Valve
- Different Types of Valves in Control Application
- Test & Inspection According to API-598
- Test Duration for Backseat Test & Body test
- Leakage Class According to FCI70-2
- Pressure Test
- Magnetic Particle Test
- NDT
- Material Certificate
- Valve Sizing and Calculation
- Tips for Valve Sizing
- Regulator Valves
- Reducing Regulator
- Direct & Pilot Operation
- Tank Blanketing System (API2000)
- Safety Devices
- Compare Control Valve & Regulator Valve
- Application of Regulator Valve in Tank Blanketing System

- Shut-off Regulator Valve
- Related Pictures and Videos
- Datasheet of Control Valves
- Control Valve Sizing and Calculation with Software according to ISA75.01.01
- **Valve Workshop**

## 9. On/Off Valve

- Different Valves in ON/Off Application
- Survey an On/Off Valve in P& ID
- Solenoid Valve
- Stroking time
- ON/Off Valves Definitions
- Ball Valves
- Butterfly Valves
- Eccentric Disk Valves
- Plug Valves
- Different types of Seats (Soft & Metal)
- Valve Body Types (Integrated/Separated/Welded Body)
- Ball Valve Size
- Floating Ball Valve
- Trunnion Mounted Valve
- Valve Limit Switches
- Fire Safe Valves
- Fire Proof Actuators
- Leakage Class
- On/Off Valves Actuators
- Single Acting and Double Acting Actuators
- Anti – Static Devices
- API 6D H.5 Anti-static Test
- ISO 17299
- PST (Partial Stroking Test)
- Air set and Local Control Panel
- Fully Welded body & Hydrostatic Test (Body test)
- LVDT on Valve
- Quadrant Ball
- Single Piston Effect (DBB) According to API-6D
- Double Piston Effect (DIB) According to API-6D
- Emergency sealant injection
- Related Pictures and Videos
- **On/Off Valve Workshop**

## 10. Pressure safety valve

- PSV Introduction and Applications
- Pressure Safety Valve (PSV) Definitions

- PSV, PRV, and PSRV
- PSV in a P&ID
- How to choose the setpoint of a PSV
- Superimposed Pressure
- Build-up Pressure
- Back Pressure
- Overpressure (BS 5500)
- Different Types of PSV (Conventional, Balanced Bellows, Pilot Operated)
- Orifice Area Designation According to API-520
- Seat Tightness According to API-527
- PSV Opening Diagram
- PSV Opening Behavior
- PSV Accessories
- Internal Parts & Accessories
- Body
- Bonnet
- Nozzle / Seat / Disk / Spring
- Blow down ring
- Rupture Disk
- How to Calibrate a PSV
- Cold Differential Test Pressure
- Installation Points
- Pilot Operated Performance
- Valve Parameters in Calculation
- Related Pictures and Videos
- Datasheet of a PSV
- Calculation and Sizing of a PSV with Software
- **PSV Workshop**

## 11. Fire & Gas Devices

- F&G (Fire & Gas)
- Introduction and Applications
- F&G Control System (NFPA72 & EN54)
- F&G Basic Parameters to Design
- ESD Logic
- F&G Logic
- Safety and Explosion Standards
- F&G Devices
- Toxic Gas Detector
- Hydrogen Gas Detector
- Different Types of Gas Detectors
- Catalytic Gas Detector (CGD)
- Infrared Gas Detector (IRGD)
- Heat Detectors



- Fixed Point
- Rate of Rise (ROR)
- Linear Heat Detector
- Flame Detectors
- UV & UV/IR Flame Detectors
- Smoke Detectors
- Heat and Smoke Detector
- Addressable vs. Conventional
- Sounder & Flasher
- Types of Sound
- Manual Call Point (MCP)
- Double Action MCP
- Fire Fighting System (Station) FFS
- Redundancy in F&G Control System
- SIL Standard
- Design F&G devices in a sample project
- Survey the cause and effect
- Related Pictures and Videos

## **12. Junction Box, Gland, Cable**

- Junction Box, Cable Glands, Cables, Cable Tray
- Introduction and Application of Junction Boxes
- How to design and choose a proper JB
- JB related Standard
- JB Material
- Cable Wiring and Terminations
- Instrument and Power Earth
- Earth Cable Wiring
- Cable Conductor Cross Section (Area) Size
- Single Pair and 2-core Cables
- Multi Pairs and Cores Cables
- Intrinsically Safe (I.S) and Non-intrinsically Safe (NIS) Cables
- Cable Color (RAL Standard)
- Survey different layers of Instrument & Control cables
- Lead Cover
- F&G Cable
- Fire Resistance Cable (IEC60331)
- Flame Retardant Cable (IEC60332)
- Cable Megger Test
- Different Types of Armors
- Cable Glands
- Ex and Safe Area Glands
- Armored and Non-armored Glands
- Gland Materials

- Gland Connection Types
- Cable Trays
- Tray Weight Test
- Related Pictures and Videos

### 13. Safety standard

- Safety Standards
- Hazardous Operational Zone
- Explosion Standards
- Ex 'd' (IEC 60079-1)
- Ex 'i' (IEC 60079-11)
- Ex'e' (IEC 60079-7)
- How to select the proper Ex Standard for Field Instruments
- Gas Group Standard
- Temperature Group Standard
- Ingress Protection (IEC60529)

### 14. Calibration

- Calibration Theory
- Basic Definitions
- Accuracy
- Precision
- Practical example
- Gain
- Ideal Line
- Zero Shift Error
- Span Error
- Zero/Span Adjusting Screw
- Linear and Non – Linear Errors
- Hysteresis Error
- Dead Band
- Uncertainty Calculation (ISO17025)

### 15. Documentation

- How to Prepare the documents in Instrumentation
- Material Requisition
- Vendor Data Requirements
- Document for Control System
- I/O List
- Instrument Cable List
- Wiring Diagram
- Cause & Effect Matrix