# Introduction:

Accurate flow measurement is essential in the oil and gas industry. This course, which includes the fundamentals of process piping engineering in oil and gas, aims to provide oil and gas processing training to facility operators, technicians, and engineers.

Participants will learn about oil and gas flow measurement, including pneumatic devices in oil and gas, and will be trained in ways that continue to work long after the course has ended.

### Targeted Groups:

- Engineers and Technicians of all disciplines
- Instrumentation Personnel
- Procurement and Quality Control Personnel
- Inspection and Maintenance Engineers involved in oil and gas certification programs

### Course Objectives:

At the end of this oil and gas process course, participants will be able to:

- Understand the Legal and Commercial Metering Requirements in the gathering system oil and gas.
- Appreciate design criteria, oil and gas security systems, and the importance of accuracy.
- Understand measurement concepts in oil and gas industry certifications and types of error.
- Understand the principles of oil and gas flow measurement, proving, and sampling.
- Evaluate oil and gas certificate programs, Turbine Meter Calibration, and Control Chart.

### Targeted Competencies:

- The laws governing fluids and gases in oil and gas process engineering courses.
- Essential principles of flow metering, including accuracy and repeatability.
- Main types and applications of flowmeters with emphasis on custody transfer.
- Flowmeter proving and calibration techniques in courses for the oil and gas industry.
- Custody transfer principles and applications in oil and gas production training courses.

# Course Content:

### Unit 1: Typical Gas System Overview:

- Typical Gas Pipeline System

- Role of Operator in oil and gas gathering system
- Overview of Typical Gas Sales Contracts

### Unit 2: Typical Gas Metering System Overview:

- Introduction to Fiscal Metering
- Pipework and Valving
- Flow Measurement in the oil and gas industry
- Secondary Instrumentation

### Unit 3: Primary Flow Measurement Instrumentation:

- The Flowmeter
- Meter Tubes and Other Fittings
- Removals/Replacement Procedure

### Unit 4: Flow Measurement Accuracy:

- Flow Measurement Uncertainty, Rangeability and Calibration
- Calculating Uncertainty
- Traceability

### Unit 5: Secondary Measurement Instrumentation:

- Pressure Measurement
- Temperature Measurement
- Density Measurement

### Unit 6: Gas Quality Measurement:

- The Gas Sampling and Conditioning System
- Relative Density Analyzer
- Moisture Analyzer

### Unit 7: Gas Chromatographs:

- Introduction to Gas Chromatography
- Gas Conditioning System
- Gas Chromatograph
- Chromatograph Controller
- Calibration and Maintenance

### Unit 8: Calibration and Proving:

- Proving and Calibration Principle.
- Flowmeter and secondary measurement proving.
- Meter prover and performance issues.
- Calibration of meter provers.
- Calibration Report calculations (Meter factor, repeatability uncertainty)

### Unit 9: Computer System Overview:

- Hardware

- Software
- Display Formats
- Alarm Handling and Interpretations
- Response to Input Failures
- Stream Flow computer (Introduction, Webserver, PC Setup, Display editor, Report Editor).
- Supervisory Computer.

### Unit 10: Supervisory Computer System:

- Hardware and Software
- Operator Interface
- System Security
- Communications

### Unit 11: Metering Panel Auxiliary Equipment:

- Analog to Digital Conversion
- Power Supplies

### Unit 12: Introduction to Primary Flow Measurement Devices:

- Introduction
- Basic Principles of Pipe Flow
- Mathematical Developments

### Unit 13: Primary Flow Measurement Devices – Differential Pressure Type:

- Simple Theory
- Orifice Meters
- Venturi Meters
- Flow Nozzles
- Low Loss Devices
- Variable Orifice Meters
- Variable Area Meters
- Pitot Tubes and Pitot Static Tubes
- Target Flowmeters

### Unit 14: Primary Flow Measurement Devices – Displacement Flowmeters:

- Basic Principles
- Liquid Meters
- Designs for Gases
- Advantages and Disadvantages
- Applications

### Unit 15: Primary Flow Measurement Devices – Rotary Inferential Meters:

- Turbine Flowmeters
- Miscellaneous Designs

- Advantages and Disadvantages

### Unit 16: Primary Flow Measurement Devices – Fluid Oscillatory Flowmeters:

- Principle of Operation
- Vortex Shedders
- Advantages and Disadvantages

### Unit 17: Primary Flow Measurement Devices – Electromagnetic Flowmeters:

- Principle of Operation
- AC and Pulsed DC Types
- Applications
- Advantages and Disadvantages

### Unit 18: Primary Flow Measurement Devices – Ultrasonic Flowmeters:

- Doppler Type
- Time-of-Flight Type
- Clamp-on Type
- Applications
- Advantages and Disadvantages

### Unit 19: Primary Flow Measurement Devices – Mass Flow Measurement:

- Coriolis Flowmeters
- Angular Momentum Devices
- Thermal Meters
- Applications
- Advantages and Disadvantages
- Troubleshooting

### Unit 20: Primary Flow Measurement Devices – Miscellaneous:

- Cross-Correlation
- Tracer Methods
- Weighing Methods
- Lasers

### Unit 21: Flow Measurement Systems and Custody Transfer Considerations:

- Custody Transfer Requirements
- Meter Factor
- Proving Systems: Direct, Indirect, Master Meter, Volume, Displacement
- Custody Transfer Skids
- Flow Computers and Communication
- Temperature and Pressure Measurements

### Unit 22: LACT Unit:

- Overview of LACT/ACT installations.
- Metering System Component overview and functionality.
- Valves in Liquid metering system.
- Temperature and pressure instrumentation in the metering system.
- Automatic Sampling System.

### Unit 23: API MPMS:

- API MPMS Ch 11.1 (Volume correction factors)
- API MPMS Ch 12 Calculation of Petroleum Quantities, related to professional certification courses in oil and gas

## Professional Certification Course in Oil and Gas:

Participants interested in advancing their oil and gas industry credentials may explore a professional certification course. It is designed to affirm a professional’s competency in specific areas of the industry, including flow measurement, instrumentation, and processing. Pursuing oil and gas industry certifications can lead to career advancements and recognition in this specialized field.