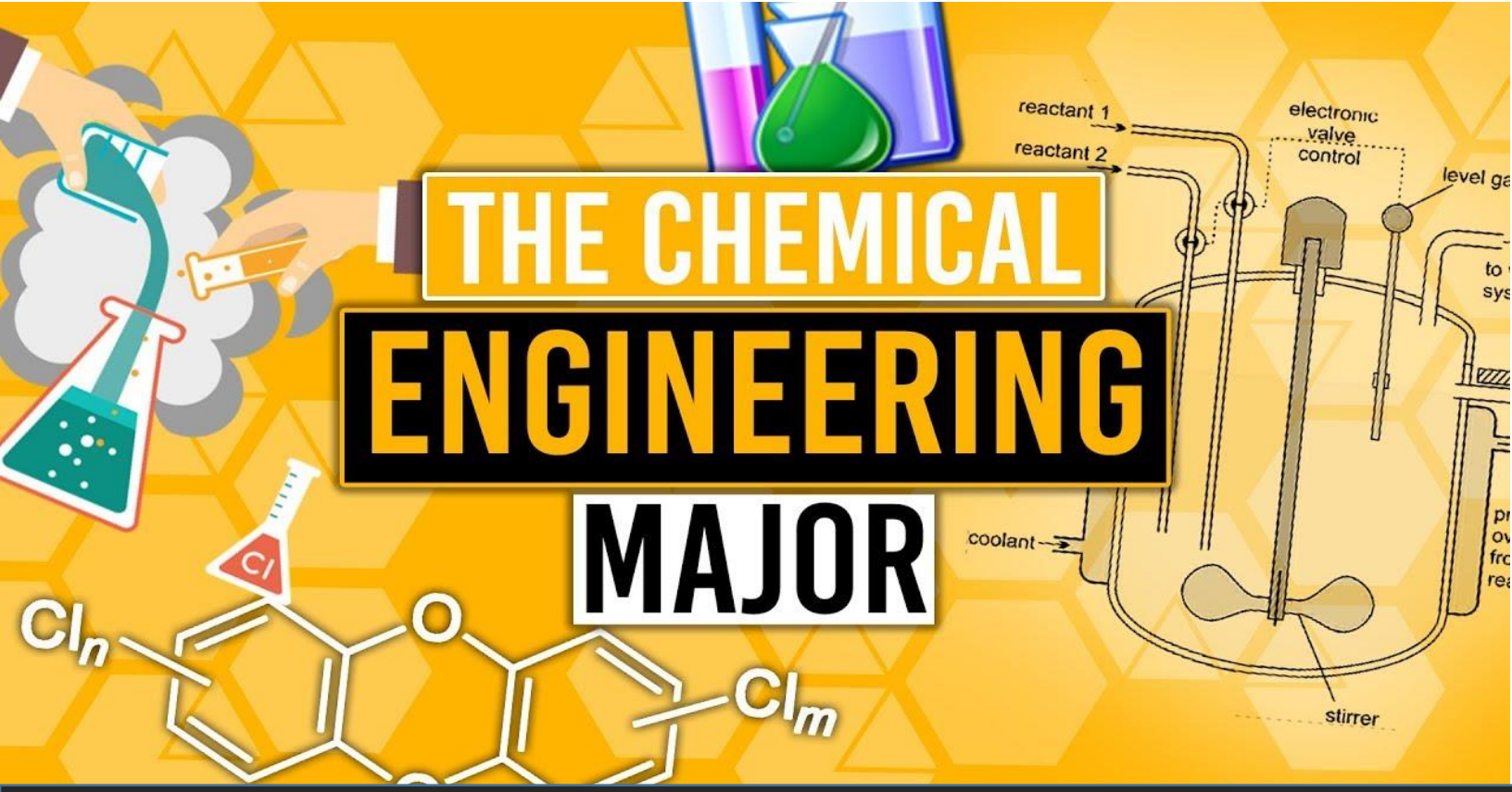

The Effective Shift Team Leader in the Oil, Gas and Petrochemicals Industries

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BTS
Training & Consultancy

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Introduction:

This intensive five-day course covers the fundamentals of Gas Flow Measurement including how to sample, analyze, and determine measurements rigorously. The slightest error in gas flow measurements, during transfer between supplier and customer, may cost millions of dollars yearly.

Gas flow measurement is used for inventory accounting, process plant mass balances, loss prevention, and regulatory as well as fiscal reporting. From the production site to the point of consumption, accurate measurements are vital. Accuracy and precision are both crucial and mandatory, particularly where fiscal custom transfer duties are to be imposed. Measurement equipment need to be selected, installed, calibrated, operated, inspected and properly maintained whilst at the same time the results must be processed and accurately accounted.

The importance of clear and precise specifications, in order to specify, procure operate and troubleshoot these instruments, both to service the needs of the company and also to meet the relevant requirements of the regulatory authority, will be taught.

This training course will feature:

Each delegate will achieve a detailed understanding of the following theoretical aspects:

- Appreciate design criteria and importance of accuracy in gas quantity and quality measurements
- Basics of measurement uncertainty
- Understand measurement concepts and types of error
- Understand the basic concepts, principles of operation and equipment used for typical liquid/gas metering systems, meter proving, sampling and analysis
- Understand typical operations, control functions and record keeping requirements for crude liquid/gas metering systems

By the end of this training course, participants will be able to:

- Specify, select and procure the right type of flow measuring device for the intended application
- Learn the theory behind a variety of gas flow measuring devices
- Appreciate the inner workings of gas flow measurement devices as well as how to maintain and troubleshoot them
- Understand issues related to reliability, reproducibility and measurement accuracy
- Understand the legal and commercial requirements for liquid/gas metering

Who is this Training Course for:

This training course has been specially developed for personnel that are required to work with and or are involved in selecting, maintaining, troubleshooting and calibrating gas flow measurement systems. It will also be of great benefit to personnel who are involved in sampling, analysis & custody transfer operations that require specific knowledge to conduct measurements & calculations in flow systems.

This training course is suitable to a wide range of professionals but will greatly benefit:

- Production Supervisors
- Instrument Supervisors
- Graduate Engineers
- Process Engineers
- Production Engineers
- Metering Engineers & Technicians
- Instrument & Analyser Technicians
- Personnel who witness or audit natural gas measurement

Training Methodology:

This course will utilise a variety of proven adult learning techniques to ensure maximum understanding, comprehension and retention of the information presented. This includes interactive sessions with questions, discussions and problem solving under supervision along with syndicate exercises. It will be conducted as an interactive workshop that encourages

participants to share their own experiences and apply the programme material to real-life situations.

The course will be reinforced by a learning mix that includes, lecture style presentation, short videos, open discussion, case studies, simulations and syndicate exercises.

What are the Goals:

The course comprises of the basic flow measurement theory of gases in pipes and conduits. The effects of pressure and temperature on flow meters and on flow measurements are explained in detail, and an insight into fluid dynamic terminology is provided, e.g. Reynolds numbers.

Particular emphasis will be given to differential pressure generating flow meters; orifice plates, Pitot tubes and Venturi meters, Coriolis, as well as other types of flow meter. The advantages and disadvantages of each type will be fully explained as well as the important interaction between flow measurement and gas sampling.

The Course Content:

Day One: Introduction to the Physics of Gas Flow

- Fluid Mechanics Concepts
- Flow Rate and Total Flow Measurement of Gases and fluids
- Units & Measurement of Flow
- Flow Sensor Selection Criteria
- Liquid/gas quality measurement

- Boiling & Cryogenic Fluids
- Gas Flow Calculations - Measured Variables

Day Two: Measurement Concepts

- Natural Gas properties & Measurement
- Standard or Normal Volume
- Design criteria and regulations
- Uncertainty in measurement
- Accuracy vs. Repeatability
- Accuracy & Rangeability
- Prover loop and associated components

Day Three: Metering systems I

- Differential Pressure Flowmeters
    - Pitot Tubes
    - Variable Area Flowmeters
- Mechanical Flowmeters
    - Positive Displacement Flow
    - Turbine Flowmeters
    - Other Rotary Flowmeters
- Metering systems Calibrations and maintenance

Day Four: Metering systems II

- Electronic Flowmeters
    - Magnetic Flowmeters
    - Vortex Flowmeters
    - Ultrasonic Flowmeters

- Mass Flowmeters
    - Coriolis Mass Flowmeters
    - Thermal Mass Flowmeters
    - Hot-Wire Anemometers
- Gas Flowmeter Troubleshooting and maintenance
- NGTS Measurement Design criteria and regulations
- Syndicate exercise: Pressure drop Calculations

Day Five: Custody Transfer Instruments

- Sampling & analysis
- Measurements & Calculations
    - Correction Methods
    - Calculation Methods
    - Calibration Frequency
    - Precision Standards
- Pressure/Density &Level Instrumentation
- Record keeping and reporting