CONCEPT

Gas Chromatography and HPLC: Operation, Method Validation and Troubleshooting

25 – 29 January 2027
Dubai - Five-star CBD venue



Gas Chromatography and HPLC: Operation, Method Validation and Troubleshooting

Ref: 190_10706 **Date:** 25 – 29 January 2027 **Location:** Dubai - Five-star CBD venue **Fees:** 19500 SAR

Introduction:

Gas chromatography and HPLC results drive product release, process control and customer certificates in oil, gas, petrochemical and industrial laboratories, yet tailing peaks, drifting baselines, shifting retention times and weak validation records still produce wrong numbers and repeat analyses. This Core Concept course takes laboratory chemists and analyzer technicians through GC and HPLC instrument operation, sample preparation, calibration, method validation, system suitability, troubleshooting and maintenance. Participants build a Chromatography Method Validation and Troubleshooting File for a GC or HPLC method from their own laboratory.

Course Objectives:

- Operate GC and HPLC systems by choosing inlet, column, mobile phase or carrier gas and detector settings that match the sample and the analyte
- Prepare samples and build calibrations using external standard, internal standard and area normalisation quantitation
- Plan and document method validation covering specificity, range, accuracy, precision and robustness as ICH Q2R2 states them
- Set system suitability criteria for resolution, plate number, tailing and injection repeatability and act on failures before reporting results
- Diagnose peak shape, baseline and retention time faults in GC and HPLC chromatograms and correct them through targeted maintenance
- Apply laboratory QA/QC checks and data integrity controls to chromatography records in line with ISO/IEC 17025

Target Audience:

- Laboratory chemists who run GC and HPLC analyses for product quality, process control and certificates of analysis
- Analyzer technicians who maintain laboratory and online process gas chromatographs
- Laboratory shift leads who review chromatograms and release results
- Quality and method development staff who validate and transfer analytical methods
- Instrument support staff who carry out preventive maintenance and repairs on chromatography systems

Course Outline:

Day 1: Chromatography Principles and Separation Fundamentals

- Stationary Phase, Mobile Phase and Partition Mechanism Explained
- Retention Time, Void Time and Retention Factor Calculation
- Plate Number, Selectivity Factor and Resolution Equation
- Chromatogram Anatomy: Peak Width, Height, Area and Integration Events
- Laboratory Chromatography Current-State Checklist: Methods, Instruments and Records

Day 2: Gas Chromatography and HPLC Instrument Architecture

- GC Inlets: Split/Splitless, On-Column, PTV and Gas Sampling Valves
- Packed Versus Capillary GC Columns and Oven Temperature Programming
- GC Detectors at Overview: FID, TCD, FPD and Mass Spectrometry
- HPLC Pumps, Autosamplers and UV, Diode Array and Refractive Index Detectors
- HPLC Modes: Reversed-Phase, Normal-Phase, Ion-Exchange and Size-Exclusion with Isocratic and Gradient Elution

Day 3: Sample Preparation, Calibration and Method Validation

- Sample Preparation Techniques: Dilution, Filtration, Extraction and Headspace
- External Standard, Internal Standard and Area Normalisation Quantitation
- Calibration Curve Construction, Linearity Checks and Response Factors
- Validation Characteristics in ICH Q2R2: Specificity, Range, Accuracy, Precision and Robustness
- System Suitability Criteria: Resolution, Tailing Factor and Injection Repeatability

Day 4: GC and HPLC Troubleshooting, Maintenance and Process Analyzers

- Peak Shape Faults: Tailing, Fronting, Split Peaks and Ghost Peaks Diagnosis
- Baseline Noise, Drift and Retention Time Shift Root Cause Table
- Preventive Maintenance: Septa, Liners, Column Trimming, Pump Seals and Check Valves
- Online Process Gas Chromatographs at Overview: Sample Conditioning, Valve Switching and Validation Blends
- Laboratory QA/QC and Data Integrity: Control Charts, Audit Trails and ISO/IEC 17025 Records

Day 5: Case Study Workshop: Method Validation and Troubleshooting File

- Case Study: Chromatogram Fault Diagnosis Set from GC and HPLC Runs
- Case Study: Validation Protocol and Acceptance Criteria for a Hydrocarbon Assay
- Case Study: Out-of-Specification Result Investigation and Corrective Action
- Build: Chromatography Method Validation and Troubleshooting File
- Validation and Troubleshooting File Peer Review and Laboratory Action Plan

Skills You Will Gain:

- Chromatographic Separation Theory
- GC and HPLC Instrument Operation
- Quantitative Calibration
- Analytical Method Validation
- System Suitability Assessment
- Chromatogram Fault Diagnosis
- Chromatography Preventive Maintenance
- Laboratory Data Integrity

Why Attend This Course:

- Return with a Chromatography Method Validation and Troubleshooting File built around a GC or HPLC method from your own laboratory
- Cut repeat injections and lost instrument time by tracing a chromatogram fault to its cause in a set order
- Defend reported results in audits and customer queries with validation evidence, system suitability records and traceable audit trails
- Compare laboratory practice with peers from refining, gas processing, petrochemical and other industrial laboratories

Conclusion:

Reliable chromatography results depend on sound separation principles, correct instrument settings, careful sample preparation, fit calibration, documented validation and disciplined maintenance. The course moves from retention and resolution fundamentals through GC and HPLC hardware, then to sample preparation, quantitation, ICH Q2R2 validation characteristics and system suitability, before tackling peak shape, baseline and retention faults, process gas chromatographs and data integrity. The final day produces a Chromatography Method Validation and Troubleshooting File ready for the next method review or laboratory audit.