COURSE OVERVIEW LE0210-4D
Advanced Gas Chromatography Techniques & Troubleshooting

Course Title
Advanced Gas Chromatography Techniques & Troubleshooting

Course Reference
LE0210-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	January 08-11, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
2	April 15-18, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
3	July 01-04, 2024	Jubail Hall, Signature Al Khobar Hotel, Al Khobar, KSA
4	October 07-10, 2024	Business Center, Concorde Hotel Doha, Doha Qatar

Course Description

This practical and highly-interactive course includes practical sessions and exercises where participants will visit the laboratory and they will be introduced to various lab instruments and gas chromatography process. Practical sessions will be performed using one of the lab equipment in order to apply the theory learnt in the class.

This course is designed to provide participants with a detailed and advanced overview on Gas Chromatography and Troubleshooting Techniques. It covers the sampling and sample handling including the contamination; the laboratory sub-sampling; the sample preservation; the holding time, the receiving and disposal of completed samples; the data reporting and the sample accountability; the different techniques of sample preparation such as adsorption, sampling, extraction, derivatization, desorption, extraction, fractionation and the clean-up.

During this interactive course, participants will learn the difference of the packed and capillary columns; the gas chromatography operation; the sample injection techniques; the GC detectors; the gas chromatography mass spectrometry; the high-speed gas chromatography; and the methods of GC validation and its troubleshooting.

Course Objectives

Upon the successful completion of this course, each participant will be able to: -

- Apply and gain an advanced knowledge on gas chromatography and troubleshooting techniques
- Discuss sampling and sample handling covering its contamination, laboratory sub-sampling, preservation, holding time, receiving
- Demonstrate disposal of completed samples, report data and explain sample accountability
- Differentiate techniques of sample preparation such as adsorption, sampling, extraction derivatization, desorption, extraction and fractionation
- Distinguish packed and capillary columns as well as explain gas chromatography operation
- Illustrate sample injection techniques and identify GC detectors and gas chromatography mass spectrometry
- Determine high speed gas chromatography and employ the methods of GC validation and troubleshooting

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of gas chromatography techniques and troubleshooting for chemists, biochemists, clinical chemists, environmentalists, petroleum chemists and other technical staff who are involved in natural products and occupational health and safety.

The course assumes a working knowledge of GC with one year of Laboratory experience, a BA/BS in chemistry or completion of our basic GC course (**LE160 Gas Chromatography Operation, Application, Troubleshooting & Method Validation**).

Training Methodology

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Workshops & Work Presentations
30% Case Studies & Practical Exercises
20% Software, Simulators & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **2.4 CEUs** (Continuing Education Units) or **24 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. **John Swinley** is a **Senior Consultant** with over **50 years** of industrial experiences in **Waste Water & Sewage Treatment** and **Operations**. His expertise widely covers in the areas of **Vacuum** Sewer System, **Vacuum** Station, **Vacuum** Pump System, **Vacuum** Sewer Line, **Gas Chromatography Techniques & Troubleshooting**, **Gas Analyzer**, **Laboratory** Instrument Calibration, **Chromatography** Data System, Isotope Ratio Mass Spectrometry, Vacuum Technology, **Spectroscopic** Techniques, Capillary GC, **Gas Analysis**, **Analytical Laboratory Audit**, **Transformer Oil Gas** Analysis, Natural & Refinery Gas Analysis, **Varian Gas Chromatography** Operation & Maintenance, **Agilent ChemStation** Operation, **GC Device Prevention & Maintenance**, **Process Analyzer**, Modern **Chemical Laboratory**, **Analytical Instrumentation**, Equipment Calibration, **GC Troubleshooting** & User Maintenance, **GC/MS Technology & Problem Solving**, Online **Gas Analyzer**, **GC/MS Mass Spectra** Interpretation, **Laboratory Equipment** Maintenance, Separation Technology, **Natural Gas Testing & Analysis** and **Natural & Refinery Testing**. He is currently involved in method development and optimization in nuclear energy, power generation and petrochemical industries wherein he troubleshoots instrument problems and introduce comprehensive GC applications for on-line analysis in petrochemistry.

During his career life, Mr. Swinley worked with several companies and institutions occupying numerous positions such as being the **Director**, **Product Manager**, **Product Specialist** and **Reseach Assistant** from the University Witwatersrand, G.D. Searle, SMM Instruments, Wirsam Scientific, Perkin Elmer SA, Scientific Group, Scientific Supply Services and Chromatography Consultants.

Mr. Swinley has a **Bachelor** degree in **Applied Mathematics and Physics** and a **Diploma** in **Industrial Electronics**. Further, he is a **Certified Instructor/Trainer** and currently working on publishing a book “Practical Gas Analysis by Gas Chromatography”. He was awarded as the “Chromatographer of the year” by the ChromSA and has delivered numerous trainings, courses, workshops, seminars and conferences internationally.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

Dubai	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day
Al Khobar	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	**US$ 5,500** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0945	***Sampling & Sample Handling*** *Sample Contamination • Laboratory Sub-Sampling • Sample Preservation • Sample Holding Time • Sample Receiving • Disposal of Completed Samples • Reporting Data • Sample Accountability*
0945 – 100	*Break*
1000 - 1200	***Sample Preparation*** *Gaseous Sample Preparation • Gaseous Analytes by Adsorption • Liquid (Aqueous) Samples • Static Headspace Sampling • Dynamic Headspace Sampling • Purge and Trap Sampling • Liquid-Liquid Extraction • Solid Phase Extraction*
1200 – 1215	*Break*
1215 – 1245	***Sample Preparation (cont'd)*** *Analyte Derivatization • Solid Samples • Thermal Desorption • Liquid Phase Extraction • Ultrasonic Extraction • Microwave Assisted Extraction • Supercritical Fluid Extraction • Fractionation & Cleanup*
1245 - 1420	***Packed versus Capillary Columns*** *Column Efficiency • Packed and Capillary Columns • Capillary Columns • Stationary Phases • Non-polar Stationary Phases • Increased Phase Polarity • Phase Polarity and Selectivity • Polyethylene Glycol Phases • Polysiloxane Stationary Phases • Phase Selectivity • Phase Thermal Stability • Siloxane Stationary Phases • Specialty Grade Stationary Phases • Phase Stabilization • Gas Solid Adsorption Columns*
1420 - 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0900	***Gas Chromatography Operation*** *Carrier Gas Selection • Carrier Gas Velocity • Column Length • Column Diameter • Stationary Phase Film Thickness • Phase Ratio • Elution Order Changes*
0900 – 0915	*Break*
0915 - 1015	***Gas Chromatography Operation (cont'd)*** *Temperature Programming • Column Fittings • Column Conditioning • Column Bleed • Retention Gap • Column Fatigue and Regeneration*
1015 – 1215	***Sample Injection*** *Syringe Technique • Split Injection • Split Flow Rates • Splitless Injection • Initial Column Temperature • Electronic Pressure Control • Programmed Temperature Vaporizing Injector • PTV Injector*
1215 – 1230	*Break*
1230 - 1420	***Sample Injection (cont'd)*** *Cool on Column Injection • Retention Gap Focusing • Large Volume Injection • PTV Large Volume Injection • Vapor Overflow Injection • Other Sampling Techniques • Selecting the Injection Mode*
1420 - 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

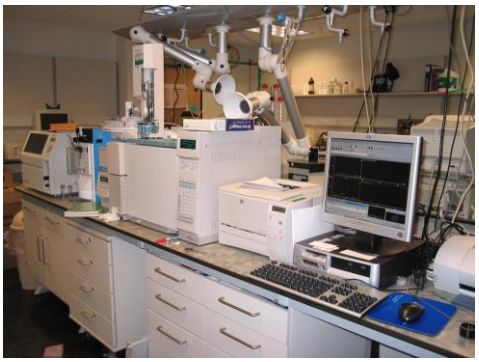
0730 – 0900	***GC Detectors*** *Noise Characteristics • Sensitivity • Limit of Detection • Dynamic Range • Linear Dynamic Range • Response Factor • Selectivity • Thermal Conductivity Detector • Flame Ionization Detector • Detector Design • Detector Operation • The Methaniser FID • Helium Discharge Ionization Detector • Pulsed Discharge Helium Ionisation Detector (PDHID)*
0900 - 0915	*Break*
0915 - 1015	***Gas Chromatography Mass Spectrometry*** *GC Mass Spectroscopy • Sample Preparation Considerations • Chromatography Considerations • GC/MS Interfaces • GCMS Ion Sources • GCMS Mass Analyzers • Magnetic Sector Analyzer • Quadrupole Analyzer • Ion Trap Analyzer • Time of Flight Analyzer • MS Detectors*
1015 – 1215	***Gas Chromatography Mass Spectrometry (cont'd)*** *Electron Multiplier • Photo Multiplier • Scanning Techniques • Full Mass Range Scanning • Selected Ion Monitoring • Multiple Ion Monitoring • Data Presentation • Background Artifacts • Electron Impact Ionization • Structural Determination • Quantitation • Isotope Labelled Standards • Quantitation without Surrogates • Response Factors versus Scan Range*
1215 – 1230	*Break*
1230 – 1420	***High Speed Gas Chromatography*** *Pressure Drop • Column Capacity • Detection Limits • Injection Band Width • Extracolumn Band Broadening • Detector Time Constant • Temperature Ramping • High Speed GCMS • HSGC Narrow Bore Columns • Fast Temperature Programming • Vacuum Outlet Operation • GC-GC • Benefits of GCGC • GCxGC Using Different Phase Columns*
1420 - 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0900	***Validation of GC Methods*** *Instrument Procurement • Performance Qualification • Service and Maintenance • Verification after Service • Personnel and Training • Standard Operating Procedures • Method Validation • Method Minimum Criteria • Method Selectivity • Method Initial Calibration*
0900 – 0915	*Break*
0915 – 1115	***Validation of GC Methods (cont'd)*** *Method Calibration Linearity • Method Precision • Method Accuracy • Limit of Detection • Method Robustness • Method Software Validation • Sample Tracking and Chain of Custody • Method Statistical Process Control • Duplicate Analysis • Written Instructions • Logbooks • Reports • Data Archival*
1115 – 1215	***Troubleshooting in Gas Chromatography*** *Systematic Troubleshooting • New Columns • Column Conditioning • Carrier Gas Purifiers • Measuring Gas Purity• Column Bleed and Septum Bleed • Blank Runs • Isolating Bleed Problems • Injection Residues*
1215 – 1230	*Break*
1230 – 1345	***Troubleshooting in Gas Chromatography (cont'd)*** *Temperature and Oxygen Effects • Column Rejuvenation • Test Mixtures • Peak Distortion • Other Sorptive Residues • Column Coupling and Junction Problems • Flame Jet Problems • Trace Level Components • Further Reading*
1345 - 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions/Site Visit

Site visit will be organized during the course for delegates to practice the theory learnt:-



Course Coordinator

Kamel Ghanem, Tel: +971 2 30 91 714, Email: kamel@haward.org