COURSE OVERVIEW LE0160-4D
Gas Chromatography Operation, Application, Troubleshooting & Method Validation

Course Title
Gas Chromatography Operation, Application, Troubleshooting & Method Validation

Course Date/Venue
March 04-07, 2024/TBA Meeting Room, Southern Sun Abu Dhabi Hotel, Abu Dhabi, UAE

Course Reference
LE0160-4D

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

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

The use of Gas Chromatography plays a key role in the modern industry, not only by supplying effective data of known quality, but also providing these data in real-time or near real-time.

This course is offering everything the professional and the novice need to know about running, maintaining, and interpreting the results from Gas Chromatography. Analytical chemists, technicians, and scientists in allied disciplines will regard this course as the best in gas chromatography. In addition to serving as an invaluable update for the experienced practitioner, this course provides the beginner with a solid understanding of gas chromatographic theory and basic techniques.

This **state-of-the-art course** incorporates the **most recent developments** in the field of Gas Chromatography, including topics on optimization of separations and computer assistance; high speed or fast gas chromatography; mobile phase requirements: gas system requirements and sample preparation techniques; qualitative and quantitative analysis by Gas Chromatography; updated information on detectors; validation and QA/QC of chromatographic methods; and useful hints for troubleshooting gas chromatographs.

This course presents a well-rounded and comprehensive overview of the current state of this important technology, providing an invaluable knowledge that will greatly appeal to both experienced chromatographers and novices.

The course manual is a very comprehensive and contains many special topics that cover modern applications of GC in numerous disciplines. It is a must-have reference on the shelves of all laboratories doing gas chromatographic analyses.

Course Objectives

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

- Apply systematic techniques on operation, application, troubleshooting and method validation of gas chromatography
- Carryout sampling, sample handling and sample preparation
- Differentiate between packed columns & capillary columns as well as carryout chromatographic processes and component separation
- Discuss the general considerations when selecting capillary columns
- Describe gas chromatographic separation effects, carryout column selection, installation and use
- Carryout sample injection, discuss the general considerations, factors effecting injection, and types of injection methods
- Identify different types of GC detectors such as thermal conductivity detectors, flame ionization, electron capture, thermionic, photoionization, flame photometric and chemiluminescent detectors
- Discuss in detail the components and functions of gas chromatography-mass spectrometry (GC/MS)
- Carryout GC validation methods, troubleshooting and applications

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 for those who need to run, operate, apply, troubleshoot, maintain and interpret the results from gas chromatography. Analytical chemists, scientists and other technical staff in allied disciplines will regard this course as the best in gas chromatography. In addition to serving as an invaluable update for the experienced practitioners, this course provides the beginners with a solid understanding of gas chromatographic theory and basic techniques.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who 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 Laboratory Consultant** with over **50 years** of industrial experiences in **Analytical and Chemical Laboratory Management**. His expertise widely covers in the areas of **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.

Course Fee

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.

Accommodation

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

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours: -

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

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

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: ***Monday, 04th of March 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Sampling & Sample Handling*** *Representative Sampling ● Effect of Sampling Error on Overall Precision ● Sample Contamination & Preservation ● Transmittal of Samples to Laboratory & Sample Receiving ● Disposal of Completed Samples ● Reporting of Data & Sample Accountability*
0930 – 0945	*Break*
0945 – 1100	***Sample Preparation*** *Sample Requirements for Gases, Liquids & Solid Samples ● Sample Clean Up, Solvent Extraction, Soxhlet Extraction, Solid Phase Extraction, Solid Phase Micro Extraction ● Sample Derivatization, Improved Volatility & Separation, Improved Sensitivity & Selectivity*
1100 – 1215	***Packed & Capillary Columns*** *Packed vs Capillary Columns ● The Chromatographic Process & Component Separation ● Effects of Carrier Gas Velocity ● Capillary Tubing ● Sources of Activity & Structural Flaws ● Silanol Deactivation ● Column Coating*
1215 – 1230	*Break*
1230 – 1420	***Capillary Columns*** *Stationary Phase General Considerations ● Polarity & Selectivity ● Types of Stationary Phases ● Gas-Solid Adsorption Columns*
1420 - 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2: Tuesday, 05th of March 2024

0730 – 0930	***Gas Chromatographic Separation Effects*** *General Considerations ● Column Flow, Average Linear Velocity and Gas Viscosity ● Choice of Carrier Gas ● The Effect of – Column Length & Diameter, Stationary Phase Film Thickness & Stationary Phase Diffusivity ● The Effect of Temperature & Temperature Programming on – Column Flow, Average Linear Velocity, Solute Retention & Chromatographic Efficiency*
0930 – 0945	*Break*
0945 – 1100	***Column Selection, Installation and Use*** *Selection of the Stationary Phase & Selectivity ● Selection of the Column Diameter & Column Length ● Selection of the Stationary Phase Film Thickness ● Column Installation & Conditioning ● Column Optimization*
1100 – 1215	***Sample Injection*** *General Considerations ● Factors Affecting Injection Band Width ● Split/Splitless Injectors ● Hot Vaporizing Injection ● Programmed Temperature Vaporizing (PTV) Injector*
1215 – 1230	*Break*
1230 – 1420	***Sample Injection (cont'd)*** *Cool On-Column Injection ● Large Volume Injection ● Purge & Trap Sampling ● Headspace & Purge & Trap Sampling*
1420 - 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3: Wednesday, 06th of March 2024

0730 – 0930	***GC Detectors*** *General Aspects ● Thermal Conductivity Detector ● Flame Ionization Detector ● Electron Capture Detector ● Thermionic Detector ● Photoionization Detector ● Flame Photometric Detector ● Chemiluminescent Detector*
0930 – 0945	*Break*
0945 – 1100	***GC/MS*** *MS Capillary Columns ● Ionization Sources - Electron Impact Ionization & Chemical Ionization ● Mass Analyzers – Time of Flight, Magnetic Sector, Ion Trap & Quadrupole Mass Analyzers*
1100 – 1215	***GC/MS (cont'd)*** *Mass Fragment Detection ● Total Ion Chromatograms ● Selective Ion Monitoring*
1215 – 1230	*Break*
1230 – 1420	***High Speed GC*** *Column Design and Operating Conditions ● Inlet Systems for HSGC ● Detectors for HSGC ● High Speed Temperature Programming ● Portable & Miniaturized HSGC Systems*
1420 - 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4: **Thursday, 07th of March 2024**

0730 – 0830	***Practical Demonstration Course*** *Agilent GC Course ● Induction & Familiarization with the Instrument ● Preparation of Gasoline Test Mixture with 3 Levels of Standard Concentrations for Method Development & Calibration ● Setting Initial Method Parameters & Running the First Standard Mixture ● Printing of Chromatogram & Discussions on Method Shortcomings & Parameter Adjustments to Achieve Component Resolution ● Column Flow Rate, Oven Temperature Profile & Integration Parameter Adjustments through Various Runs of the Mixture until Participants Develop the Method to Achieve Full Component Resolution ● Method Calibration & Analysis of the Gasoline Sample ● Septa, Inlet Liner, Column Cutter Demonstrations ● Other Demonstrations of the GC and Software ● Breaks throughout as Required*
0830 - 0930	***Validation of GC Methods*** *Installation Qualification (IQ) ● Operational Qualification (OQ) ● Performance Qualification (PQ) ● Method Validation – Selectivity, Initial Calibration, Linearity, Accuracy, Precision, Range, Limit of Detection, Limit of Quantification, Ruggedness & Robustness ● Sample Tracking & Chain of Custody*
0930 – 0945	*Break*
0945 – 1215	***Troubleshooting & Applications*** *General Considerations ● Use of Test Mixtures ● Column Bleed, Temperature & Oxygen Effects, Column Rejuvenation ● Peak Distortion, Column Coupling & Junctions, Flame Jet Problems ● Other Problems ● Petroleum & Chemical Related Applications*
1215 – 1230	*Break*
1230 – 1345	***Summary/Open Forum & Course Evaluation***
1345 - 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions/Site Visit

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

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