

COURSE OVERVIEW LE0210

Advanced Gas Chromatography Techniques & Troubleshooting

Course Title

Advanced Gas Chromatography Techniques & Troubleshooting

Course Date/Venue

April 28 – May 02, 2024/Oryx Meeting Room, Double Tree by Hilton Al Saad, Doha, Qatar

Course Reference

LE0210

Course Duration/Credits

Five days/3.0 CEUs/30 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.



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 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**).

Course Fee

US\$ 6,000 per Delegate. 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.

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: -

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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 **3.0 CEUs** (Continuing Education Units) or **30 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.

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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:



Dr. Ian Kaloudis, PhD, MSc, PGrad, BSc, is a **Senior Analytical Chemist** with almost **30 years** of extensive experience. His expertise widely covers in the areas of **Chemical Analysis, Chemical Laboratory, Laboratory Management, Laboratory Supervision & Management, Gas Chromatography, Analytical Laboratory Management, Modern Analytical Laboratory: Management, Laboratory Consumables Management, Laboratory Instrument Calibrations & Troubleshooting**

Techniques, Safety and Quality in Scientific Laboratory, Laboratory Skills, Pesticides Application, PAH, VOC, Advanced Oxidation Processes (AOP), Phenols, Cyanotoxins, Gas Chromatography (GC), Mass Spectrometry (MS), GC/MS Technology & Problem Solving, High Performance Liquid Chromatography (HPLC), HPLC-ICP-MS/ICP-MS, Analytical Instrumentation Equipment, Gas Chromatography Mass Spectrometry, High Speed Gas Chromatography, Safety & Quality (ISO 17025), Analytical Instrumentation for Laboratory, GC Detectors, Analytical Chemistry, Analytical Laboratory Quality Management System, Waste Water Treatment, Elucidation of Mechanisms, Statistical Analysis of Data, Statistical Quality Control (SQC), Statistics Methods & Measurement Uncertainty, ISO 17025:2017, Food Safety and Environmental Management Systems. He is currently the **Head of Organic Micropollutants Laboratory** of Athens Water Supply and Sewerage Company wherein he is responsible for the development & validation for the determination of organic pollutants in water, research projects related to water quality and development of cyanotoxins analysis laboratory.

All throughout his career life, Dr. Kaloudis had occupied several challenging positions and dedication as **Quality Manager, Head of Industrial Waste Water Control Section, Consultant, Senior Researcher, Collaborating Researcher, Research Associate, Lecturer, Trainer** and **Auditor** for various companies such as the KEK DIASTASI - Hellenic Food Authority Training Programs, University of the West of Scotland, Institute of Nanoscience and Nanotechnology (INN), Hellenic Accreditation System (E.SY.D.), Institute of Physical Chemistry, Food Industrial Research and Technological Development Company and Athens Water Supply and Sewerage Company (EYDAP SA).

Dr. Kaloudis has a **PhD** degree in Chemistry (Honors) from the **National and Kapodistrian University of Athens**, a **Master** degree in **Quality Management** from the **University of the West of Scotland**, a **Postgraduate Programme in Production Management & Quality Management** from **Technical Educational Institute (TEI) of Piraeus**, a **Bachelor** degree in **Chemistry (Honors)** from **National and Kapodistrian University of Athens**. Further, he is a **Certified Instructor/Trainer**, a **Certified ISO 17025:2017 Auditor**, a **Registered Food Safety and Hygiene Trainer**, a **Certified ISO 9001 Lead Auditor** from International Register of Certificated Auditors (IRCA), a **Certified Environmental Management Systems Auditor** from Institute of Environmental Management and Assessment (IEMA), a member of the American Chemical Society (ACS), a senior member of the American Society for Quality (ASQ), a member of the International Water Association (IWA), a member of the European Water Platform, a member of the Hellenic Mass Spectrometry Society (HMSS), a member of the Italian Society of Toxicology and a member of the Association of Greek Chemists (AGC). He has further published numerous journals/books and delivered various trainings, seminars, conferences, workshops and courses globally.

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: Sunday, 28th of April 2024

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 – 1000	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 Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day One

Day 2: Monday, 29th of April 2024

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 Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3: Tuesday, 30th of April 2024

0730 – 0900	GC Detectors Noise Characteristics • Sensitivity • Limit of Detection • Dynamic Range • Linear Dynamic Range • Response Factor • Selectivity • Thermal Conductivity Detector
0900 - 0915	Break
0915 - 1015	GC Detectors (cont'd) Flame Ionization Detector • Detector Design • Detector Operation • The Methaniser FID • Helium Discharge Ionization Detector • Pulsed Discharge Helium Ionisation Detector (PDHID)
1015 – 1215	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
1215 – 1230	Break
1230 – 1420	Gas Chromatography Mass Spectrometry (cont'd) Time of Flight Analyzer • MS Detectors • Electron Multiplier • Photo Multiplier • Scanning Techniques • Full Mass Range Scanning • Selected Ion Monitoring • Multiple Ion Monitoring
1420 - 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

Day 4: Wednesday, 01st of May 2024

0730 – 0800	Gas Chromatography Mass Spectrometry (cont'd) Data Presentation • Background Artifacts • Electron Impact Ionization • Structural Determination • Quantitation • Isotope Labelled Standards • Quantitation without Surrogates • Response Factors versus Scan Range
0800 – 0915	High Speed Gas Chromatography Pressure Drop • Column Capacity • Detection Limits • Injection Band Width • Extracolumn Band Broadening • Detector Time Constant • Temperature Ramping
0915 – 0930	Break
0930 – 1045	High Speed Gas Chromatography (cont'd) High Speed GCMS • HSGC Narrow Bore Columns • Fast Temperature Programming • Vacuum Outlet Operation • GC-GC • Benefits of GCCG • GCxGC Using Different Phase Columns
1045 – 1215	Validation of GC Methods Instrument Procurement • Performance Qualification • Service and Maintenance • Verification after Service • Personnel and Training • Standard Operating Procedures
1215 – 1230	Break
1230 - 1420	Validation of GC Methods (cont'd) Method Validation • Method Minimum Criteria • Method Selectivity • Method Initial Calibration • Method Calibration Linearity • Method Precision • Method Accuracy • Limit of Detection
1420 - 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

Day 5: Thursday, 02nd of May 2024

0730 – 0900	Validation of GC Methods (cont'd) Method Robustness • Method Software Validation • Sample Tracking and Chain of Custody • Method Statistical Process Control • Duplicate Analysis • Written Instructions • Logbooks • Reports • Data Archival
0900 – 0915	Break
0915 – 1115	Troubleshooting in Gas Chromatography Systematic Troubleshooting • New Columns • Column Conditioning • Carrier Gas Purifiers • Measuring Gas Purity • Column Bleed and Septum Bleed
1115 – 1215	Troubleshooting in Gas Chromatography (cont'd) Blank Runs • Isolating Bleed Problems • Injection Residues • Temperature and Oxygen Effects • Column Rejuvenation • Test Mixtures
1215 – 1230	Break
1230 – 1345	Troubleshooting in Gas Chromatography (cont'd) Peak Distortion • Other Sorptive Residues • Column Coupling and Junction Problems • Flame Jet Problems • Trace Level Components • Further Reading
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

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



Course Coordinator

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