

COURSE OVERVIEW LE0075
Modern Chemical Laboratory

Analytical Instrumentation, Equipment Calibration, Operations, Quality & Safety

Course Title

Modern Chemical Laboratory: *Analytical Instrumentation, Equipment Calibration, Operations, Quality & Safety*

Course Date/Venue

Session 1: February 09-13, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 1: August 03-07, 2025/Business Meeting, Crowne Plaza Al Khobar, Al Khobar, KSA



Course Reference
LE0075



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.



The function of many of today's chemical laboratories is not always easily described. To those in the laboratory it may seem to be at the core of all operations, since the information it provides affect major decisions that can determine the very existence of the organization it serves.



To others, it is merely a convenient way to obtain data on which to base their actions so that they can spend most of their time pursuing more productive activities. In fact, elements of truth are to be found in both concepts. However, everybody agrees about the importance of chemical laboratory for each process plant.

The course links together an understanding of performance characteristics with an appreciation of the limitations imposed by analytical instrument design, leading to the interplay of the validation and qualification processes within quality assurance systems.

The course includes unique framework of topics covers the major instrumental techniques of spectrophotometry, chromatography, capillary electrophoresis and atomic emission spectroscopy. The use of case studies, exercises and practical applications, will help participants to develop a thorough understanding of the various concepts that underpin the different techniques.

The course will cover the major operations performed in an industrial chemical laboratory. It will describe the major equipment used in the chemical laboratory, their operations, validations, calibration and maintenance. The course will concentrate on Standard Operation Procedures (SOP) which includes development, revisions, standards and implementations. Various Quality standards will be discussed. However, the course will concentrate on ISO 17025:2005. Finally, the course will demonstrate the safety practices and its critical impact in an industrial chemical laboratory. OSHA standards and regulations will be discussed and related videos will be shown to course participants.

In addition to the updated knowledge provided to course participants during the course period, each participant will go back to his/her laboratory equipped with an outstanding manual that includes typical SOPs that can be modified and used within participant's laboratory. Further, participants will be given 12 video tapes, compressed in one CD that can be used by the participant in training colleagues and subordinate on laboratory safety.

The outstanding course is a must for every laboratory professional. The updated knowledge and techniques covered during the 5 days of this course, will dramatically improve not only the participant's skills, but will also improve the performance of the participant's laboratory as a whole. However, if you are looking to improve the performance of your laboratory, then you have to commit yourself to pass the knowledge gained in this course to your subordinates and colleagues back in your laboratory as we will give you all the tools needed for this purpose; knowledge, skills, manual, power point slides, videos, Standard Operation Procedures (SOP), forms, and standards.

Course Objectives

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

- Apply an in-depth knowledge and skills in the chemical laboratories including analytical instrumentation, analytical techniques, laboratory equipment, operational procedures, management style, method validation, quality and safety management systems
- Use the major analytical laboratory instruments and equipment and understand their performance characteristics, capabilities, accuracies, reliabilities, speed and limitations including UV/VIS spectrophotometers, atomic absorption spectroscopy, ICP-OES, flow injection, infrared/raman spectroscopy, ion chromatography, pH probes, and gas chromatography
- Calibrate and certify various laboratory instruments and calculate uncertainty and random error
- Analyze the instrument performance characteristics which include types and interaction between different characteristics
- Prepare and handle sample for different analytical instrumentations and extract analytes from complex matrices



- Develop and modify the laboratory standard operating procedures (SOP) and interpret the requirements of the ISO 17025 quality system
- Explain the flow of work and major concerns related to the Industrial Chemical Laboratory
- Gain an in-depth knowledge about laboratory equipment and instruments such as mechanical measurements, chemical analysis and process analyzers
- Carryout sampling and sample handling
- Discuss nuclear magnetic instruments covering its theory, NMR spectroscopy, design and performance idea
- Illustrate NMR applications, multi-dimensional NMR spectroscopy and solid-state NMR spectroscopy
- Perform chemical laboratory operations and gain good skills of developing and modifying the laboratory Standard Operating Procedures (SOP)
- Implement the quality assurance system for chemical laboratory in accordance with the ISO 17025 standard
- Employ the safety and environmental requirements for chemical laboratory as per OSHA standard

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 modern chemical laboratory for those who are involved in analytical instrumentation, equipment calibration, operations, quality and safety including laboratory managers, engineers, chemists, scientists and other laboratory technical staff. Further, the course is suitable for instrumentation engineers and other instrumentation staff who are in-charge of instrument calibration and maintenance.

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 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: -

-  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.

-  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.

Accommodation

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





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. Hesham Abdou, PhD, MSc, BSc, is a **Senior Engineer** with over **35 years** of practical experience in various industrial fields. His specialization widely covers in the areas of Management, Operations, SPC & Quality **ISO 17025**, Risk Management & **ISO 17025**, Medical Laboratory Quality Management **ISO 15189:2007**, Lab Instrument Calibration & Troubleshooting Techniques, Modern **Analytical** Laboratory, Safety in **Analytical** Laboratories, **Analytical** Chemistry & Precise Results Generation, **Network** Management & Supervision,

Basics Waste Water Treatment, Fundamentals of Water **Utility Regulation**, Operation & Maintenance of **Water Networks**, Water Meter Reading System (**MMR**), Operation & Maintenance of **Sewerage System**, **Principles** of Routine & Preventive Maintenance, **Safety Procedures** in Water Networks, **Sewer & Treated Effluent Network** System, **Sewer Network** Repair & Maintenance, **Valve Chamber** Maintenance, **Water** Analysis & Testing, **Water** Sampling Procedures, **Water System Design** & Installation, **Water Networks Design** Procedures, **Water Pumping** Process, **Equipment Handling** Procedures, **Pipes, Fitting & Valves**, **Pipelines**, **Pumps**, **Turbines**, **Heat Exchangers**, **Separators**, **Heaters**, **Compressors**, **Storage Tanks**, **Valves** Selection, **Compressors**, **Tank & Tank Farms** Operations & Performance, **Piping & Pumping** Operations, **Pump** Performance Monitoring, **Rotor Bearing** Modelling, **Hydraulic** Repairs & Cylinders, **Root Cause Analysis**, **Vibration & Condition** Monitoring, **Piping Stress** Analysis, **Gas Conditioning & Processing**, **Cooling Towers** Operation & Troubleshooting, **PCP & Jet Pump**, **Acid Gas** Removal, **Chemical Engineering Process** Design, **Hydrocracker Process Unit** Technology, **Hydro-Treating** Technology, **Distillation** Design, **Production Quality & Process** Troubleshooting, **Process Plant** Optimization, **Rehabilitation**, **Revamping & Debottlenecking**, **Heat Medium Fired Heater** Troubleshooting & Maintenance, **Hydro-Treating** Technology, **Process Plant** Performance & Efficiency, **Hydro Treating & Hydrocracker** Technology, Basics of Operation and Supervision of **Water Tanks Filling Stations**, **Amine Gas Sweetening & Sulfur Recovery**, Heat & Mass Transfer and Fluid Mechanics.

During his career life, Dr. Hesham held significant positions and dedication as the **General Manager**, **Operations Manager**, **Maintenance Manager**, **Section Head**, **Process Engineer** and **Mechanical Engineer** in various companies.

Dr. Hesham has a **PhD** and **Master's** degree in **Mechanical Engineering** and a **Bachelor's** degree in **Process Engineering**. Further, he is a **Certified Instructor/Trainer** and a **Peer Reviewer**. Dr. Hesham is a member of Egyptian Engineering Syndicate. Moreover, he has published technical papers and journals and has delivered numerous trainings, workshops, courses, seminars and conferences internationally.

Course Fee

US\$ 5,500 per Delegate + **VAT**. 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 and Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Sampling & Sample Handling Course Overview • Sampling Errors • Representative Sampling • Sample Contamination and Sample Preservation • Sample Accountability
0930 – 0945	Break
0945 – 1100	Laboratory Instrument – UV/VIS Spectrophotometers Spectrophotometer Architecture • Sources, Filters and Detectors • Sampling Devices • Fibre Optic Probes • Miniature Spectrophotometers
1100 – 1230	Laboratory Instrument – Infrared & Raman Spectroscopy Background for Vibrational Spectroscopic Measurements • Comparison of Techniques and Relative Roles • IR Instrumentation • Instrumentation: Design and Performance Criteria • Fourier Transform Instruments • Filter Instrumentation • Laser Based Systems
1230 – 1245	Break
1245 – 1420	Laboratory Instrument - NMR Theory of Nuclear Magnetic Resonance • NMR Spectroscopy • Instrumentation: Design & Performance Criteria • NMR Applications • Multi-Dimensional NMR Spectroscopy • Solid-State NMR Spectroscopy
1420 - 1430	Recap
1430	Lunch & End of Day One

Day 2

0730 – 0930	Laboratory Instrument – Atomic Absorption Spectroscopy Introduction • Flame AAS • Nebulizer/Burner systems • Atomisation and Interferences • Graphite Furnace AAS • Pyrolysis and Atomization • The STPF Concept
0930 – 0945	Break
0945 – 1100	Laboratory Instrument – ICP - OES Inductively Coupled Plasma - Optical Emission Spectroscopy • Principals of Optical Emission Spectroscopy • Atomic Spectroscopy Sources • Techniques and Instruments • Analytical Performance • Applications of ICP-OES
1100 – 1230	Laboratory Instrument – Gas Chromatographs Separation Systems • Selection of Carrier Gases • Gas Chromatography Columns • Column Stationary Phases • Injectors and Detectors • Gas Chromatography – Mass Spectrometry • High Speed and Portable GC
1230 – 1245	Break
1245 – 1420	Laboratory Instrument – Ion Chromatography Introduction • Ion Exchange Chromatography • Ion Exclusion Chromatography • Ion Pair Chromatography • Ion Suppression Chromatography • Conductivity/Suppressed Conductivity Detection • Amperometric Detection • Photometric Detection • Critical Instrumental Aspects
1420 - 1430	Recap
1430	Lunch & End of Day Two



Day 3

0730 – 0930	Laboratory Instrument – Electrochemical Techniques Principals of Conductivity • Immersed Electrodes – 2 an 4 Electrode Cells • Electrodeless (Non-contact) Measurement • pH Probes – Theory, Calibration, Measurement and Maintenance • Anodic and Cathodic Stripping Voltammetry
0930 – 0945	Break
0945 – 1100	ISO 17025 Standard ISO 17025 Standard and Accreditation • Why Standardize? • Technical Competence
1100 – 1230	Method Validation Validation Strategy • Validation of Standard Methods • Revalidation • Validation of Analytical Methods • IQ, OQ and PQ
1230 – 1245	Break
1245 – 1420	Data Validation & Uncertainty Data Validation and Reporting • Measurement Uncertainty • Summary Recommendations
1420 - 1430	Recap
1430	Lunch & End of Day Three

Day 4

0730 – 0930	SOP's & Quality Systems Anatomy of an SOP • SOP Styles • Statistical Quality Control – Testing Frequency and Control Charts • Audits and System Reviews
0930 – 0945	Break
0945 – 1100	SOP's & Quality Systems (cont'd) Audits and System reviews • Audits – Responsibility, Planning, Training, Conducting and Reporting • Responsibilities for Quality
1100 – 1230	Laboratory Efficiency Testing & OHS A Requirements Proficiency Testing Procedure • Evaluation of Proficiency Testing • Advantages for Laboratories and Performance Improvements
1230 – 1245	Break
1245 – 1420	Laboratory Efficiency Testing & OHS A Requirements (cont'd) OHS A Standard • Chemical Hygiene Plan • Employee Information and Training • MSDS's
1420 - 1430	Recap
1430	Lunch & End of Day Four

Day 5

0730 – 0930	Certified Reference Standards & Traceability Certified Standards • Applications of Certified Standards • Types of Reference Materials
0930 – 0945	Break
0945 – 1100	Certified Reference Standards & Traceability (cont'd) Regulatory and Standards Requirements • Laboratory Requirements
1100 – 1230	HR & Safety Videos Recruitment Considerations • Communicating Job Responsibilities
1230 – 1245	Break



1245 - 1345	HR & Safety Videos (cont'd) <i>Training and Documentation • A Series of Chemical Laboratory Safety Videos</i>
1345 - 1400	Course Conclusion
1400 - 1415	POST-TEST
1415 - 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>

Practical Sessions

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



Course Coordinator

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