



COURSE OVERVIEW LE0443 **Laboratory Instruments Calibration & Troubleshooting** **Techniques**

Course Title

Laboratory Instruments Calibration & Troubleshooting Techniques

Course Date/Venue

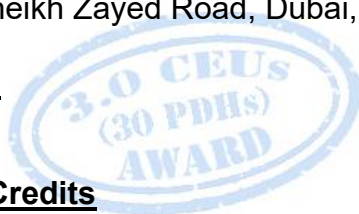
October 25-29, 2026/Boardroom 1, Elite Byblos
Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference

LE0443

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 up-to-date overview of Laboratory Instruments Calibration & Troubleshooting Techniques. It covers the laboratory instruments and measurement systems; the fundamentals of metrology and calibration; the measurement accuracy, precision and performance characteristics; the calibration standards, procedures and good laboratory practices; the measurement uncertainty and error analysis, calibration management system and documentation; and the laboratory balances, weighing systems and temperature, pressure and vacuum measuring instruments.



Further, the course will also discuss the volumetric laboratory equipment, pH meters and electrochemical instruments; the conductivity and dissolved oxygen meters, spectrophotometer calibration, performance verification and chromatography instrument calibration; the laboratory ovens, furnaces and incubators; the centrifuge calibration and performance testing; the calibration of turbidity, moisture and specialized meters; and the data acquisition and electronic measuring devices.



During this interactive course, participants will learn the laboratory instrument troubleshooting, electrical and electronic troubleshooting techniques and mechanical and pneumatic troubleshooting; the sensor and signal troubleshooting techniques and preventive and predictive maintenance of laboratory instruments; the root cause analysis of recurring instrument failures, calibration quality management and ISO/IEC 17025 principles; and the out-of-tolerance calibration, impact assessment, advanced instrument diagnostic techniques, calibration optimization and reliability improvement.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on laboratory instruments calibration and troubleshooting techniques
- Discuss the laboratory instruments and measurement systems including the fundamentals of metrology and calibration
- Describe the measurement accuracy, precision and performance characteristics and apply calibration standards, procedures and good laboratory practices
- Carryout measurement uncertainty and error analysis as well as calibration management system and documentation
- Calibrate laboratory balances and weighing systems including temperature, pressure and vacuum measuring instruments
- Calibrate volumetric laboratory equipment, pH meters and electrochemical instruments and conductivity and dissolved oxygen meters
- Carryout spectrophotometer calibration, performance verification and chromatography instrument calibration
- Calibrate laboratory ovens, furnaces and incubators and apply centrifuge calibration and performance testing
- Calibrate turbidity, moisture and specialized meters as well as data acquisition and electronic measuring devices
- Employ laboratory instrument troubleshooting, electrical and electronic troubleshooting techniques and mechanical and pneumatic troubleshooting
- Carryout sensor and signal troubleshooting techniques and preventive and predictive maintenance of laboratory instruments
- Apply root cause analysis of recurring instrument failures and calibration quality management and ISO/IEC 17025 principles
- Employ out-of-tolerance calibration, impact assessment, advanced instrument diagnostic techniques, calibration optimization and reliability improvement



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 laboratory instruments calibrations and troubleshooting techniques for production chemists, laboratory staff and those who are using major laboratory instruments such as GC, GC/MS, LC, ICP etc. This includes chemists, scientists, analysts, instrument engineers and laboratory technical staff.

Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

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.

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 who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's 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**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.



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. Yousef Al-Mashni, PhD, MSc, BSc, is an **International Expert** in **Analytical Laboratory** with over **30 years** of extensive experience. He is an **authority** in **Laboratory Equipment, Laboratory Quality Management Systems (ISO 17025 and ISO 15189), Lab Safety & Health, Good Laboratory Practice (GLP) and Safety Procedure in Laboratories**. His wide expertise also covers **Water Analysis & Reporting, Water Sampling & Testing, Water Analyzer, Medical Laboratory Auditing, ISO 15489, Infection Control, Internal Quality Control for Microbiologists, Analytical Techniques, Biochemical, Hematological, Parasitological, Biochemical, Microbiological & Serological Analysis of Clinical Specimens, Helminth Ova & Salmonella in Waste Water & Sludge, Microbiological Aspects & Analysis of Wastewater, Microbiology of Wetlands, Microbiological Indoor Air Quality, Enterococcus, Pseudomonas & Aeromonas, Sulfate Reducing Bacteria, Fluorescence Microscopy, Planktology of Ambient Environment, Oral, Medical & Diagnostic Microbiology and Oral & Dental Hygiene**. Further, he is also well-versed in the areas of **Food Hygiene and HACCP, Food Safety, Food Poisoning, First Aid & CPR and Fire Safety**. He is currently the **Deputy Principal & Chief Technical Instructor** of **UNRWA** wherein he is responsible in developing and managing operations at the college/centre including building workshops and laboratories capacity, curriculum development and introducing new courses.

During his long career life, Dr. Yousef worked for many international companies handling key positions such as **ICDL Centre Manager, Deputy Principal, Chief Technical Instructor, Acting Principal, Laboratory Supervisor, Technical Instructor, Technical & Vocational Instructor, Senior Medical Laboratory Technician and Medical Laboratory Technician**.

Dr. Yousef has a **PhD** degree in **Natural Health Sciences** from the **University of Florida (USA)**, **Master** degree in **Clinical Microbiology** and **Bachelor** degree with **Honours** in **Microbiology**. Further, he has **Diploma** in Vocational Education (**UNRWA & UNESCO**) and received several **certifications** like **ICDL** and Training of Trainers (**TOT**) in **Cambridge University (England)**. He is a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)**, a **Certified Instructor/Trainer** and an active member of **Jordan Medical Laboratories Society, Technical Accreditation Committee of Medical Laboratories (Jordan Institution & Metrology)** and the **Technical Accreditation Committee for Granting ISO 15189 Certificate**. Furthermore, he has also published numerous technical papers and books including **Medical & Diagnostic Microbiology, Practical Competencies in Medical Laboratory Technology, Safety in Medical Laboratory Science and Quality Control in Medical Laboratory Science** just to name a few.



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, 25th of October 2026

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Introduction to Laboratory Instruments & Measurement Systems Classification of Laboratory Instruments & Their Applications • Measurement Principles, Instrument Functions & Operating Characteristics • Analog versus Digital Laboratory Instrumentation • Instrument Specifications, Measuring Ranges, Resolution & Sensitivity
0930 – 0945	Break
0945 – 1030	Fundamentals of Metrology & Calibration Principles of Metrology & Measurement Science • Calibration, Verification, Adjustment & Validation Concepts • Traceability to National & International Measurement Standards • Calibration Hierarchy, Reference Standards & Working Standards
1030 – 1130	Measurement Accuracy, Precision & Performance Characteristics Accuracy, Precision, Repeatability & Reproducibility • Resolution, Sensitivity, Linearity, Hysteresis & Stability • Systematic Errors, Random Errors & Gross Errors • Bias, Drift, Tolerance & Acceptance Limits
1130 – 1215	Calibration Standards, Procedures & Good Laboratory Practices Development & Use of Standard Calibration Procedures • Selection, Handling & Storage of Reference Standards • Environmental Conditions Affecting Calibration Accuracy • Good Laboratory Practices for Reliable Measurements
1215 – 1230	Break
1230 – 1330	Measurement Uncertainty & Error Analysis Sources & Classification of Measurement Uncertainty • Type A & Type B Evaluation of Uncertainty • Combined & Expanded Measurement Uncertainty • Interpretation & Reporting of Calibration Results
1330 – 1420	Calibration Management System & Documentation Calibration Scheduling & Instrument Identification Systems • Calibration Certificates, Records & Equipment History • Calibration Status Labels & Due-Date Control • Handling of Out-of-Tolerance & Nonconforming Instruments
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, 26th of October 2026

0730 – 0830	Calibration of Laboratory Balances & Weighing Systems Operating Principles of Analytical & Precision Balances • Zero, Repeatability, Linearity & Eccentricity Checks • Calibration Using Certified Reference Weights • Troubleshooting Unstable, Drifting & Inaccurate Readings
0830 – 0930	Calibration of Temperature Measurement Instruments Calibration of Thermometers, RTDs & Thermocouples • Use of Dry-Block Calibrators & Temperature Baths • Comparison Calibration & Reference Temperature Standards • Detection of Sensor Drift, Offset & Response Problems



0930 – 0945	Break
0945 – 1100	Calibration of Pressure & Vacuum Measuring Instruments Operating Principles of Pressure Gauges & Transducers • Calibration Using Deadweight Testers & Pressure Calibrators • Zero, Span, Linearity & Hysteresis Verification • Troubleshooting Leakage, Drift & Pressure Measurement Errors
1100 – 1215	Calibration of Volumetric Laboratory Equipment Calibration of Pipettes, Burettes, Flasks & Measuring Cylinders • Gravimetric Calibration Methods & Water Density Corrections • Volume Accuracy, Repeatability & Acceptance Criteria • Identification of Leakage, Contamination & Handling Errors
1215 – 1230	Break
1230 – 1330	Calibration of pH Meters & Electrochemical Instruments Principles of pH Measurement & Electrode Operation • Selection & Preparation of Certified Buffer Solutions • Two-Point & Multi-Point pH Calibration Techniques • Troubleshooting Electrode Drift, Slow Response & Unstable Reading
1330 – 1420	Calibration of Conductivity & Dissolved Oxygen Meters Conductivity Measurement Principles & Cell Constants • Calibration Using Conductivity Reference Solutions • Dissolved Oxygen Sensor Calibration & Compensation • Troubleshooting Sensor Fouling, Drift & Temperature Effects
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, 27th of October 2026

0730 – 0830	Spectrophotometer Calibration & Performance Verification UV-Visible Spectrophotometer Operating Principles • Wavelength Accuracy & Photometric Accuracy Verification • Baseline, Stray Light & Resolution Performance Checks • Troubleshooting Noise, Drift & Abnormal Absorbance Results
0830 – 0930	Chromatography Instrument Calibration Fundamentals of Gas & Liquid Chromatography Systems • Flow Rate, Temperature & Detector Performance Verification • Retention Time, Resolution & System Suitability Testing • Troubleshooting Peak Tailing, Baseline Noise & Retention Shifts
0930 – 0945	Break
0945 – 1100	Calibration of Laboratory Ovens, Furnaces & Incubators Temperature Controller & Sensor Verification • Temperature Uniformity & Stability Testing • Multi-Point Temperature Mapping Techniques • Troubleshooting Temperature Deviations & Control Problems
1100 – 1215	Centrifuge Calibration & Performance Testing Centrifuge Operating Principles & Critical Parameters • Verification of Rotational Speed Using a Tachometer • Timer & Temperature Calibration Techniques • Troubleshooting Vibration, Imbalance & Speed Deviations
1215 – 1230	Break
1230 – 1330	Calibration of Turbidity, Moisture & Specialized Meters Turbidity Meter Calibration Using Reference Standards • Moisture Analyzer Performance & Weight Verification • Zero, Span & Multi-Point Calibration Methods • Troubleshooting Contamination, Optical & Sensor Errors



1330 – 1420	Calibration of Data Acquisition & Electronic Measuring Devices Digital Multimeters & Electrical Measurement Fundamentals • Voltage, Current, Resistance & Frequency Verification • Signal Simulator & Multifunction Calibrator Applications • Troubleshooting Electrical Connections, Noise & Signal Errors
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, 28th of October 2026

0730 – 0830	Fundamentals of Laboratory Instrument Troubleshooting Structured Troubleshooting Methodology & Logical Fault Isolation • Differentiating Instrument, Method, Sample & Operator Errors • Symptom Analysis & Root Cause Identification • Use of Manuals, Schematics, Diagnostic Codes & Service Records
0830 – 0930	Electrical & Electronic Troubleshooting Techniques Power Supply, Fuse, Cable & Grounding Checks • Testing Sensors, Circuits, Connections & Electronic Components • Using Digital Multimeters for Fault Diagnosis • Identifying Open Circuits, Short Circuits & Intermittent Faults
0930 – 0945	Break
0945 – 1100	Mechanical & Pneumatic Troubleshooting Inspection of Pumps, Valves, Tubing, Seals & Connections • Detection of Leaks, Blockages & Flow Restrictions • Troubleshooting Motors, Bearings & Mechanical Drive Systems • Preventing Contamination, Wear & Mechanical Failure
1100 – 1215	Sensor & Signal Troubleshooting Techniques Sensor Failure Modes & Common Measurement Problems • Checking Zero, Span, Response Time & Signal Stability • Diagnosing Noise, Interference, Ground Loops & Signal Loss • Sensor Cleaning, Replacement, Recalibration & Functional Testing
1215 – 1230	Break
1230 – 1330	Preventive & Predictive Maintenance of Laboratory Instruments Developing Instrument-Specific Preventive Maintenance Programs • Cleaning, Inspection, Lubrication & Consumable Replacement • Monitoring Instrument Drift & Performance Trends • Maintenance Scheduling, Checklists & Service Documentation
1330 – 1420	Root Cause Analysis of Recurring Instrument Failures Failure Mode Identification & Problem Definition • Application of 5 Whys & Fishbone Analysis • Corrective & Preventive Action Development • Verification of Corrective Action Effectiveness
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, 29th of October 2026

0730 – 0830	Calibration Quality Management & ISO/IEC 17025 Principles Relevant ISO/IEC 17025 Calibration Requirements • Equipment Control, Metrological Traceability & Recordkeeping • Ensuring Validity of Calibration & Measurement Results • Internal Quality Control & Calibration System Audits
0830 – 0930	Out-of-Tolerance Calibration & Impact Assessment Identification of Out-of-Tolerance Conditions • Assessment of Previously Generated Laboratory Results • Instrument Quarantine, Adjustment, Repair & Recalibration • Documentation, Corrective Action & Release-to-Service Requirements
0930 – 0945	Break
0945 – 1100	Advanced Instrument Diagnostic Techniques Interpretation of Error Messages & Diagnostic Indicators • Comparison Testing Using Known Reference Standards • Trend Analysis for Drift & Progressive Deterioration • Distinguishing Hardware, Software, Sensor & Method Problems
1100 – 1230	Calibration Optimization & Reliability Improvement Establishing Risk-Based Calibration Intervals • Analyzing Calibration History & Instrument Performance • Reducing Unnecessary Calibration & Instrument Downtime • Improving Measurement Reliability & Laboratory Productivity
1230 – 1245	Break
1245 – 1330	Practical Calibration & Troubleshooting Workshop Performing Calibration Checks on Selected Laboratory Instruments • Recording As-Found & As-Left Calibration Results • Diagnosing Simulated Instrument Faults & Measurement Errors • Applying Corrective Actions & Confirming Instrument Performance
1330 - 1345	Integrated Case Studies Case Study on Calibration Failure & Measurement Deviation • Troubleshooting Exercise Using a Systematic Diagnostic Approach • Preparation & Review of Calibration/Troubleshooting Reports
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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