COURSE OVERVIEW IE0605

Advanced Gas Metering & Gas Chromatography Systems

Principles, Operation, Calibration, and Data Integration

Course Title

Advanced Gas Metering & Gas Chromatography Systems: *Principles, Operation, Calibration, and Data Integration*

Course Date/Venue

December 14-18, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Reference

IE0605

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

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 up-to-date overview of Advanced Gas Metering & Gas Chromatography Systems: Principles, Operation, Calibration, and Data Integration. It covers the principles of gas flow measurement including gas properties, flow characteristic essentials and differential pressure, volumetric and mass flow measurement; the metering technologies, system components and configuration and design and installation practices; and the error sources and measurement uncertainty including operation of gas metering systems.

Further, the course will also discuss the preventive and predictive maintenance, calibration of gas flow meters, laboratory calibration and data verification; the maintenance and reliability in metering, advanced diagnostics, digital communication, remote monitoring and data acquisition; the fundamentals of gas chromatography; and the GC system components and operation, GC calibration and quality assurance.

During this interactive course, participants will learn the preventive maintenance of GC systems, GC data analysis and application in custody transfer and process measurement; the data management and reporting, supervisory systems for gas measurement, regulatory and fiscal compliance and communication protocols; linking measurement systems to business processes; and the operational auditing and error investigation.

Course Objectives

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

- Apply and gain an advanced knowledge and the principles, operation, calibration, and data integration of gas metering and gas chromatography systems
- Discuss the principles of gas flow measurement including gas properties, flow characteristic essentials and differential pressure, volumetric and mass flow measurement
- Apply metering technologies, system components and configuration and design and installation practices
- Recognize error sources and measurement uncertainty including operation of gas metering systems
- Carryout preventive and predictive maintenance, calibration of gas flow meters and laboratory calibration and data verification
- Employ maintenance and reliability in metering, advanced diagnostics and digital communication and remote monitoring and data acquisition
- Discuss the fundamentals of gas chromatography and apply GC system components and operation, GC calibration and quality assurance
- Implement preventive maintenance of GC systems, GC data analysis and application in custody transfer and process measurement
- Apply data management and reporting, supervisory systems for gas measurement, regulatory and fiscal compliance and communication protocols
- Link measurement systems to business processes and apply operational auditing and error investigation

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 and liquid measurement technologies, operation, calibration and gas chromatography for measurement engineers and technicians, instrumentation and control engineers, process engineers, calibration and metrology personnel, operations and maintenance staff, laboratory technicians, quality assurance and compliance officers and supervisors and managers.

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:

Mr. **Nikolas Karnavos**, MSc, BSc, is a **Senior Analytical Chemist** with over **30 years** of extensive experience within the **Oil**, **Gas**, **Refinery** and **Petrochemical** industries. His expertise widely covers **Gas & Liquid Chromatograph Process Analysers**, **Process Analyzer Techniques** (**Online** & **Offline**), Laboratory Information Management System (**LIMS**), **Data & Method Validation in Analytical Laboratories**, Laboratory **Automation Techniques**, **Practical Problem Solving in Chemical Analysis**, **Practical Statistical Analysis of Lab Data**, **Chemical Laboratory**, **Analytical Laboratory & Instrumentation**, Laboratory **Health & Safety**, **GLP**, Laboratory **Quality Management** (**ISO 17025**), **ISO 9001** and Medical Laboratory Quality Management (**ISO 15189**). Further, he is also well-versed in Environmental **Online Analyzers** (**Air** & **Water**), **Gas Chromatography** and various instrumental methods of analysis such as **Water Analysis & Quality Control**, **Water and Wastewater Chemical** Analysis, **Statistical Data and Laboratory Analysis**, **Gas** Analysis, **Qualitative Fuel** Analysis, **Environmental Chemical** Analysis, **Laboratory Environmental** Analysis including Water Quality Testing, Process Water and **Wastewater Effluents**, Oily **Sludge Treatment**, Atomic Absorption and Spectroscopic Methods in Analytical Chemistry, **Analytical Method Development** and **Methods of Environmental Measurements** (**Water**, **Air**, **Liquid** & **Solid Wastes**).

Mr. Karnavos was the **Laboratory Manager** of **Exxon** wherein he was responsible for **ISO 17025 certification**, upgrading laboratory equipment in **refinery**, **petrochemical** and **polypropylene** plants, upgrading and extending LIMS, handling the transition plan process of the existing laboratory to a new as well as formulating and executing the plans for applied research and technology transfer. During his career life, he had occupied several significant positions as the **Laboratory Analyst**, **Laboratory Professor**, **Quality Manager**, **Partner & Managing Director**, **Environmental Engineer**, **Process Engineer**, **Environmental Management Corporate Department Head** and **Quality Control & Plastics Application Head** with different international companies like the **AQUACHEM**, **Hellenic Petroleum** (**EXXON**) and **Technological Institute**.

Mr. Karnavos holds a **Master** degree in **Chemical Engineering** and **Bachelor** degrees in **Mechanical Engineering** and **Petroleum Engineering** from the **Aristotelian University of Thessaloniki**, **Technological Institute** and **KATEE Kavala** respectively. He is an **Accredited Trainer** for the Organization for the Certifications & Vocational Guidance (**EOPPEP**), a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**), a **Certified Instructor/Trainer** and an **Accredited Environmental Auditor** from the **IEMA**. Further, he is the **President** of Greek **Association of Chemical Engineers** and an active member of various professional engineering bodies internationally like the **IEMA**, **Technical Chamber** of Greece and the **CONCAWE**. He also **published numerous books** and **scientific papers** and delivered various trainings and workshops worldwide.

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.

Accommodation

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

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 workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1:	***Foundations of Gas Flow Measurement***
0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Principles of Gas Flow Measurement*** *Gas Properties and Flow Characteristic Essentials • Differential Pressure, Volumetric, and Mass Flow Measurement • Mechanical versus Electronic Devices*
0900 - 0930	***Overview of Metering Technologies*** *Turbine, Ultrasonic, Vortex, Coriolis Meters • Selection Criteria for Gas Meters*
0930 – 0945	*Break*
0945 – 1030	***System Components & Configuration*** *Transmitters, Flow Computers, SCADA/DCS Integration • System Accuracy and Repeatability*
1030 – 1130	***Design & Installation Practices*** *Skid Design, Piping Layout, Installation Best Practices*
1130 – 1215	***Error Sources & Measurement Uncertainty*** *Error Types, Calibration Drift, Environmental Impacts • Data Correction and Compensation*
1215 – 1230	*Break*
1230 – 1330	***Operation of Gas Metering Systems*** *Start-up, Shutdown Procedures, Diagnostics • Reading/Interpreting Metering Data, Safety Precautions*

1330 – 1420	***Preventive & Predictive Maintenance*** *Sensor Inspection, Troubleshooting Failures • Reliability-Centered Maintenance, Documentation*
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: Advanced Metering Operation, Calibration, and Error Control

0730 – 0830	***Calibration Fundamentals*** *Importance and Standards, Traceability (ISO/IEC 17025) • Primary versus Secondary Calibration Methods*
0830 - 0930	***Calibration of Gas Flow Meters*** *Setup and Procedure for Turbine, Ultrasonic and Coriolis Meters • Comparison Techniques, Zero Flow, and Linearity Verification*
0930 – 0945	*Break*
0945 – 1100	***Laboratory Calibration & Data Verification*** *Calibration Rigs, Correction Factors, Recording, and Verification*
1100 – 1145	***Practical Demonstration/Case Studies*** *Data Interpretation, Troubleshooting Calibration Issues*
1145 - 1215	***Maintenance & Reliability in Metering*** *Scheduling, Spare Parts Management, Best Practices*
1215 – 1230	*Break*
1230 – 1330	***Advanced Diagnostics & Digital Communication*** *Supervisory Integration, Smart Transmitters • HART, Modbus, Digital Protocols*
1330 – 1420	***Remote Monitoring & Data Acquisition*** *Automated Flow Control, Remote Diagnostics*
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: Principles & Practice of Gas Chromatography (GC)

0730 – 0830	***Fundamentals of Gas Chromatography*** *Principle of Operation, Separation, Detection • Columns, Injectors, Detectors, Carrier Gases*
0830 – 0930	***GC System Components & Operation*** *Installation, Configuration, Sampling Methods • Emerson GC Example Overview*
0930 – 0945	*Break*
0945 – 1100	***GC Calibration & Quality Assurance*** *Calibration Gases, Reference Standards • Baseline, Detector Tuning, Troubleshooting*
1100 – 1145	***Preventive Maintenance of GC Systems*** *Scheduled Checks, Cleaning, Performance Issues*
1145 - 1215	***GC Data Analysis*** *Chromatograms, Component Identification, Quantitative Analysis*
1215 – 1230	*Break*

1230 – 1330	***Application in Custody Transfer & Process Measurement*** *Fiscal Role of GC, Linking Results to Metering*
1330 – 1420	***Group Exercise: Data Analysis Scenarios***
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: Data Management, Integration & Compliance

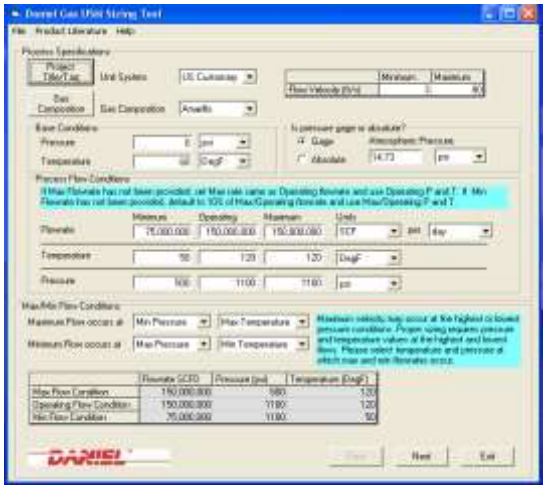
0730 – 0830	***Data Management & Reporting*** *Linking GC and Metering Data, Energy Content Calculation*
0830 – 0930	***Supervisory Systems for Gas Measurement*** *SCADA/DCS, Remote Monitoring Concepts*
0930 – 0945	*Break*
0945 – 1100	***Regulatory & Fiscal Compliance*** *National/International Standards Overview*
1100 – 1145	***Best Practice Reviews*** *Operational Checklists, QA/QC for Gas Measurement*
1145 - 1215	***Communication Protocols*** *Practical Examples and Troubleshooting*
1215 – 1230	*Break*
1230 – 1330	***Linking Measurement Systems to Business Processes*** *Reporting, Auditable Trail, Error Tracking*
1330 – 1420	***Open Forum: Troubleshooting & "Ask the Expert"***
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: Integration, Case Studies & Wrap-Up

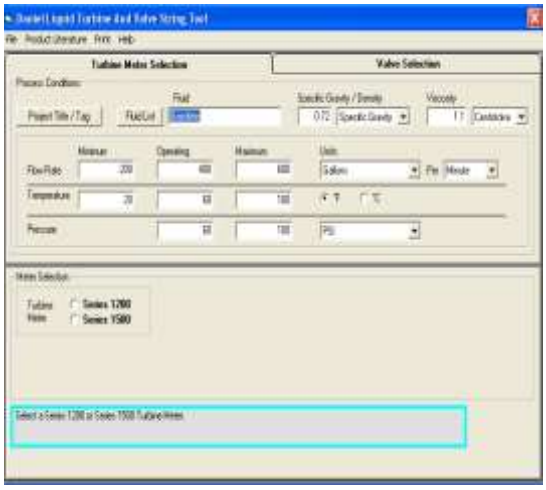
0730 – 0830	***Advanced Integration Scenarios*** *Real-World Case Studies, Emerson and Multi-Vendor Environments*
0830 – 0930	***Operational Auditing & Error Investigation***
0930 – 0945	*Break*
0945 – 1100	***Practical Data Analysis Session*** *Review/Analyze Sample Field and Lab Datasets (Guided)*
1100 – 1245	***Summary of Best Practices*** *Key Takeaways and Action Planning*
1245 – 1300	*Break*
1300 – 1345	***Participant Presentations/Feedback*** *Sharing Learning, Ideas for Future Improvements*
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*

Simulator (Hands-on Practical Sessions)

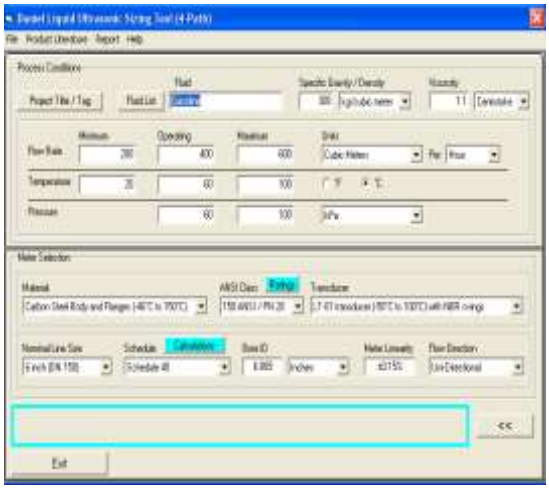
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators "Gas Ultrasonic Meter Sizing Tool", "Liquid Turbine Meter and Control Valve Sizing Tool", "Liquid Ultrasonic Meter Sizing Tool" and "Orifice Flow Calculator" simulator.



Gas Ultrasonic Meter (USM) Sizing Tool Simulator



Liquid Turbine Meter and Control Valve Sizing Tool Simulator



Liquid Ultrasonic Meter Sizing Tool Simulator

Orifice Flow Calculator Simulator

Practical Sessions/Site Visit

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

Course Coordinator

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