COURSE OVERVIEW IE0896
Process Analyzer & Analytical Chemistry

Course Title
Process Analyzer & Analytical Chemistry

Courser Date/Venue
December 14-18, 2025/Piri Reis Meeting Room, Mövenpick Hotel Istanbul Golden Horn, Istanbul, Turkey

Courser Reference
IE0896

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.

Analytical instruments used for online chemical analysis of process streams or plant environments are generally called Process Analyzer Systems or Quality Measuring Instruments. Reliable online analytical data is crucial for a safe and efficient operation and not limited to the oil & gas and chemical industry but also for pharmaceutical, power generation and other industries. Legislative requirements, economic as well as health and safety, emissions control and energy conservation are set in increasing stringent limits for reliable analyzer data which may result in huge losses or fines to the operating company.

For latter reasons, it is obvious that sustainable optimum performance of online instrumentation, sample-handling systems and correct data handling is indispensable which requires continual professional attention from the analyzer engineers and technical staff.

To achieve optimal performance, a thorough understanding of operating principles, possible interferences and practical skills are key requirements.

In this course, complete analyzer systems are discussed while special attention is given to applied sampling systems next to the main types and principles of currently applied process analyzers ranging from physical properties, online chromatography, water type analysis to gas detection systems while advantages and disadvantages are clarified with the aim to enhance the understanding of operational ranges and limitations of each type of analysis system.

Course Objectives

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

- Apply and gain an in-depth knowledge on process analyzer and analytical chemistry
- Describe the purpose, operation of sample handling and application of a process analyzer system, quality monitoring systems and gas detection systems
- Identify and explain the different types of QMI applications like process quality control and emission monitoring
- Recognize the basic tools for analytical performance and quality assurance
- Carryout quality monitoring instruments (QMI), measurement accuracy and quality assurance
- Apply analyzer sampling and conditioning and analyze instrumentation problems
- Discuss vapor pressure and describe the principles of the physical property analyzers and gas chromatography
- Identify the various types of GC detectors and peak quantitation methods
- Apply viscosity theory and measurement as well as discuss calorimeters and dissolved oxygen
- Carryout moisture theory and analysis methods, spectroscopic analysis, IR, UV, FTIR and pH measurement
- Conduct TDS measurement, oxygen analysis, turbity, hardness and TOC analysis
- Perform density measurements as well as flammable and toxic gas monitoring

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 a complete and up-to-date overview on process analyzer and analytical chemistry for those who are regularly involved with process analyzer systems like instrument engineers and production, operation, laboratory and instrument staff.

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.

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

Course Fee
US$ 6,000 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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. Emad Al-Hasany, PhD, MSc, BSc is a **Senior Engineer** with extensive experience within the **Oil & Gas**, **Refinery** and **Petrochemical** industries. His wide expertise covers in the areas of **Process Analyzer & Analytical Chemistry**, **Process Analyser** Sampling & Conditioning, **Spectroscopic** Analysis, Flammable & Toxic Gas Monitoring, **Gas & Liquid Chromatograph Process Analysers**, **Process Analyzer Techniques** (**Online** & **Offline**), Laboratory Information Management System (**LIMS**), **Data & Method Validation in Analytical Laboratories**, Laboratory **Automation Techniques**, **Statistical Analysis** of Lab Data, **Chemical Laboratory**, **Analytical Laboratory & Instrumentation**, Laboratory **Health & Safety**, **GLP**, Laboratory **Quality Management** (**ISO 17025**), **ISO 9001**, Environmental **Online Analyzers** (**Air** & **Water**), **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**). Further, he is also well-versed in **Centrifugal Compressor & Steam Turbine** Maintenance & Troubleshooting, **Heat Exchangers & Fired Heaters** Operation & Repair, **Heat Medium Fired Heater** Troubleshooting & Maintenance, **Pumps**, **Compressors**, **Turbines** & Troubleshooting, **Centrifugal Compressor & Steam Turbine**, **Valves**, **Safety Relief Valve Sizing**, Selection, Operation, Inspection, Maintenance & Troubleshooting, **Tank & Tank Farms**, **Hydraulic Pump**, **Well Engineering**, **Pumps**, **Turbines**, **Compressors**, **Process Plant Commissioning**, **Cost Estimation**, **Process Plant Start-Up Management**, **Clean Fuel** Technology & Standards, **Process Reactor** Operation & Troubleshooting, **Process Equipment** Design, Sizing, Selection, Applications & Troubleshooting, **Process Engineering Calculations**, **Gas Processing Plant** Operations & Control, **Gas Processing** Monitoring & Troubleshooting and **Process Plant** Optimization & Energy Conservation.

During his career life, Dr. Emad has gained his practical and field experience through his various significant positions and dedication as the **Production Main Station Manager**, **Manager**, **Safety Engineer**, **Production Superintendent**, **Production Supervisor**, **Production Engineer**, **Mechanical Engineer**, **HAZOP Consultant**, **Laboratory Consultant**, **Instructor** and **Lecturer** for various companies and universities such as the AL-Euphrates University, Dero Oilfields, Syrian Petroleum Company (SPC), Kokab Co. and Alharratah Oilfield.

Dr. Emad has a **PhD** in **Reservoir Management**, a **Master's** degree in **Production Engineering** and a **Bachelor's** degree in **Petroleum Engineering**. Further, he is a **Certified Instructor/Trainer** and has further delivered numerous training, courses, workshops, seminars and conferences 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.

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, 14th December 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to the World of QMI*** *Why Instruments? ● Where do We Need it? ● What Types are There? ● What is Measurement? ● Measurement Standards ● Traceability ● Quality Assurance ● Response*
0930 – 0945	*Break*
0945 – 1100	***Measurement Accuracy & Quality Assurance*** *Measurement Standards ● Units & Systems ● Introduction to Quality Assurance ● Traceability & Organization ● Definitions Accuracy, Systematic Errors & Precision ● Factors Influencing Accuracy ● Measurement Calibration Procedure ● Hysteresis Accuracy, Precision, Standard Deviation & Variance ● Playing Darts ● Repeatability & Reproducibility ● Variability & Probability ● Statistical Control & Normal Distribution ● STD & Systematic Error ● Control Chart Tool ● Setting-up a Control Chart for Performance Monitoring ● Warning & Control Limits ● Statistical Decision Rules ● Historical STD ● Reproducibility Rate*
1100 – 1230	***Analyser Sampling & Conditioning*** *Process Analyser Sampling & Conditioning ● Analyser Systems ● Conditioning ● Analysis & Sampling Organization ● Process Conditions ● Dead Volumes ● Phase Diagram ● Specific Engineering Issues ● Sample Lag Time ● Sampling Systems Examples ● Sample Recovery*
1230 – 1245	*Break*
1245 – 1330	***Analyzing Instrumentation Problems*** *Troubleshooting Approach ● Key Issues ● Best Practices*
1330 – 1420	***Vapor Pressure*** *Significance & Definitions ● Vapor Pressure Properties ● Volume & Saturated Pressure ● Vapor Pressure & Boiling Point Relation ● Evaporation of a Liquid ● Evaporation & Boiling ● Norms & Standards ● Reid Vapor Pressure & Grabner Development ● On-line Vapor Pressure Analyzers*
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, 15th December 2025**

0730 – 0930	***Principles of Gas Chromatography*** *History ● Combination of GC & MS ● What is Chromatography? ● Retention Phenomena ● Separation Factors ● Retention Factor ● Types of Chromatographic Columns ● Band Broadening & Column Efficiency ● Theoretical Plate Model ● Temperature Influence on Separation ● Van 'Deemter' Efficiency Curve ● Selection of the Type of Carrier Gas ● Peak Selectivity & Resolution ● Base Line Properties, Noise & LOD*
0930 – 0945	*Break*
0945 – 1100	***Types of GC Detectors & Peak Quantitation Methods*** *Thermal Conductivity Detector & Measurement ● Flame Ionization Detector ● Dynamic Range of Detectors ● Application of Make-up Gas ● Electron Capture Detector*
1100 – 1230	***Types of GC Detectors & Peak Quantitation Methods (cont'd)*** *Flame Photometric Detector ● Detector & Relative Response Factors ● Integration Methods ● Analysis Data Processing ● Standard Calibration Methods*
1230 – 1245	*Break*
1245 – 1420	***Viscosity Theory & Measurement*** *Dynamic Viscosity ● Shear Stress ● Types of Liquid Viscosity ● SAE System ● Kinematic Viscosity Measurement ● Types of Lab Analysis ● Capillary Type of Measurement ● Vibrational Types ● New Developments*
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, 16th December 2025**

0730 – 0930	***Calorimeters*** *Introduction to Calorimetry ● Types of Calorimeters ● Determination of Heating Values ● Higher & Lower Heating Value ● Wobbe Index & CARI ● Online Wobbe Index Analyzer ● NMR Application*
0930 – 0945	*Break*
0945 – 1100	***Dissolved Oxygen*** *Oxygen Saturation in Water ● Dissolved Oxygen Measuring Techniques ● Clarke Cell ● Amperometric Type DO Measurement ● Interferences ● Spectroscopic Type DO Measurement ● Principle of Luminescence DO Sensor ● Advantages of LDO Sensor*
1100 – 1230	***Moisture Theory & Analysis Methods*** *Dew Point/Frost Point ● Water Vapor Properties ● Dalton's Law ● Dew Point/Pressure Relationship ● Relative Humidity ● Psychrometric RH Measuring Method ● Moisture Analysis Methods ● SiO2 and AlOx Sensors*
1230 – 1245	*Break*
1245 – 1420	***Moisture Theory & Analysis Methods (cont'd)*** *Electrolytic Type Moisture Sensor ● Quartz Crystal (Ametek) Moisture Analysis ● Chilled Mirror DP Analysis ● New Developments ● Spectroscopic Moisture Analysis ● IR/NDIR Moisture Analysis ● Tunable Diode Laser Moisture Sensor ● Moisture Sample Conditioning*
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, 17th December 2025

0730 – 0930	***Spectroscopic Analysis IR, UV & FTIR*** *Types of Spectral Absorptions ● Spectral Ranges ● Relation Frequency & Wavelength ● Diffraction Methods ● Principles & Techniques Applied ● Types of Spectroscopy ● Lambert Beer's Law ● NIR Spectrum ● Industrial Non-Dispersive IR Analysis ● UV Analysis ● FT-IR & FTNIR ● How are FTIR Results Obtained? ● Practical Differences FTIR & IR ● Raman Spectroscopy ● Spectrometers for CEMS ● NMR Application*
0930 – 0945	*Break*
0945 – 1100	***pH Measurement*** *Reasons for pH Analysis ● Introduction to pH Measurements ● Construction of the Glass Measuring Electrode ● Types of pH Electrodes and their Application ● pH Measuring Circuit ● pH Measuring Principle & Nernst Equation ● Potentials Present in a pH Loop ● Asymmetry Potential ● pH Practical Notes & Measuring Range ● pH Buffers & Calibration Conditions ● pH-Temperature Compensation Clarification in Relation to Process Temperature ● Conditioning, Storage & Cleaning of pH Sensors ● Checking & Calibration of pH System*
1100 – 1230	***Conductivity & TDS Measurement*** *Basis Construction of a Conductivity Cell ● Specific Conductivity ● Cell Constant ● Liquid Conductivity & TDS Ranges ● Application of Conductivity Measurements ● Conductivity versus Concentration ● Relation Conductivity & TDS Measurement*
1230 – 1245	*Break*
1245 – 1420	***Conductivity & TDS Measurement (cont'd)*** *Principle Toroidal Conductivity Measurement ● Applied Type of Voltage & Polarization Effects ● Four Electrode Type Sensors ● Principle Difference Between the Type of Temperature Compensation pH & Conductivity ● α Factors of Common Type of Liquids ● High Conductivity Measurements*
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, 18th December 2025

0830 – 0930	***Oxygen Analysis*** *Main Applied Methods for Oxygen Measurement ● Principle of Electrochemical Cell ● Introduction to Combustion Control ● Stoichiometric Ratio ● ZrO2 Type Oxygen Analyzers ● Operating Principle ZrO2 Analysis ● Nernst Equation ● Combustion Possible Interferences ● Paramagnetic Type Oxygen Analyzer ● Background Gas Interference ● Sampling & Installation ● Magnetic Wind Type Analysis ● Troubleshooting ● New Development – 'LaserGas' Single Path Oxygen Analyzer*
0930 – 0945	*Break*
0945 – 1230	***Turbidity, Hardness & TOC Analysis*** *Turbidity Measurements ● FTU & NTU Type Turbidity ● Water Hardness Types & Analysis ● Photometric Measuring Principles ● Nernst Law Application ● Why Measuring TOC? ● Main Steps TOC Analysis ● Oxidation Methods ● Industrial Types of TOC*
1230 – 1245	*Break*

1245 – 1315	***Density Measurements*** *Significance of Density ● Applied Density Terms ● Lab Density Determination ● Oscillating Type Densitometer ● U-type Density Transducer ● Nucleonic Type Density Meter ● Specific Gravity Measurement ● Hydrostatic Type ● Gas Density Transducer Installation ● Density Verification Methods*
1315 – 1345	***Flammable & Toxic Gas Monitoring*** *Gas/Vapor Hazards ● Detection Objectives ● Gas Detection Factors ● Gas Grouping ● Lower & Upper Explosion Limits ● Alarm Settings ● Effects of Toxic Gas Exposure ● Catalytic Type Sensors ● Electro-chemical Type Sensors ● IR Gas Detection ● Open Path IR Detector ● Principle of Open Path IR ● Semi-conductor Type Detector ● Thermal Conductivity Type Detector ● Paper Tape Type of Detection ● Calibration of Sensors Procedure*
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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