COURSE OVERVIEW LE0200
Process Analyzer Technology

Course Title
Process Analyzer Technology

Courser Date/Venue
Session 1: April 27- May 01, 2025/Business Meeting, Crowne Plaza Al Khobar, Al Khobar, KSA
Session 2: December 07-11, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Courser Reference
LE0200

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 process analyzers. Practical sessions will be performed using one instrument in order to apply the theory learnt in the class.

The analysis of process liquids and gases in today's oil, gas and chemicals industries requires accurate knowledge of composition and make up of process fluids. This in turn means accurate measurement of those compositions. Without measurement there can be no control and no information as to the state of the process. Similarly, we have no way of knowing if we are causing environmental damage without this type of monitoring.

With the advancement in computer applications and electronics, analyzers have gained popularity in recent years. They have taken the spot sampling capability of a laboratory and converted into a continuous sampling system. With continuous sampling, the process variable is being analyzed on a continuous basis with a much faster update time. Faster update time has given the analyzer the ability to be used for control purposes.

This course is designed to cover the purpose of analyzer systems, how they are selected and their installation and maintenance. Course participants will learn how a sample is conditioned so the analyzer will give a representative reading of the component that is of interest in the process.

The course describes the major types of process analyzers and the principles behind the selection, construction and operation of each analyzer. It covers multiple measurement techniques ranging from physical, thermal, electrical, and optical techniques through those utilized in electrochemistry, chromatography and spectroscopy. It also touches on maintenance, system packaging and system errors consideration.

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 technology
- Discuss quality measuring instruments, measurement accuracy and quality assurance
- Perform analyzer selection, problems identification and best practices implementation
- Apply viscosity measurement and vapour pressure measurement
- Carryout analyzer sampling and conditioning as well as analyzing of instrumentation problems
- Discuss the principles of gas chromatography, detectors and quantitation methods
- Determine process of gas chromatography utilities, moisture theory and analysis, oxygen analysis and spectroscopic analysis
- Perform pH process, conductivity, TDS, density and coriolis measurement
- Analyze electrochemical covering principles of EC O2-cell, basics of ORP measurements, applications, standards H2 Electrode and Nernst equation
- Discuss H2 analyser, dissolved oxygen, water cut analysis, hardness, TOC analysis, Wobbe index and calorimeters

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 is intended for those working on process plants and plant laboratories who are seeking knowledge and skills in analytical measuring instruments and process analyzers. This includes instrumentation engineers, measuring engineers, UD engineers, supervisors, online instrument analyzer personnel, analytical instrument personnel and other technical staff on all types of oil, gas, refineries, petrochemical and other process plants. The course will also benefit the laboratory personnel who work closely with plant personnel and therefore should have an understanding of the types of process instruments used and any associated limitations.

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: -

- 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.

- 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.

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:

Mr. Dirk Horst is a **Senior Engineer** with over **35 years** of extensive experience in **On and Off-Line Gas Chromatography**, **Natural Gas Determination of Composition and Associated Uncertainty by Gas Chromatography (ISO 6974)**, **QMI** (**Quality Measuring Instruments**), **Process Analyzers**, **Crude Metering System**, **Analytical Instrumentation**, **Process Control & Instrumentation**, **Process Troubleshooting, Measuring Instruments**, **Calibrating Instruments**, **LNG Custody Transfer Analysis**, **ISO Standards**, **Quality Assurance Monitoring System** and **In-Line Gasoline Blending System**. He is **Certified Instrument Trainer**, **Competence Assessor** and **Internal Verifier**.

Mr. Horst has performed significant contributions in various industries for handling challenging positions such as an **Engineering Trainer & Consultant**, **Process Analyzer Engineer**, **Instrument Engineer**, **Maintenance Engineer**, **Design Engineer**, **Start-Up & Commissioning Engineer**, **Senior Advisor Quality Measuring Instruments**, **Senior Analytical Chemist** and **Team Leader**. He has imparted his practical experience and in-depth knowledge in different international companies including **Shell Refinery**, **Shell Global Solutions**, **SIOP-Shell**, **Yokogawa LNG**, **QMI**, **Harburg Refinery**, **Nigeria LNG**, **Sakhalin LNG**, **SRTCA**, **Reliance Petroleum Refinery** and many more.

Mr. Horst has a **Bachelor** degree in **Instrumentation & Electrical Engineering** from the **Royal Institute of the Netherlands**. Further, he is "**Qualified Internal Verifier**" and a "**Certified Competence Assessor**" and has certifications in "**Coaching**" from the **City & Guilds** as well as "**Flow Metering**" and "**Gas Chromatography Troubleshooting**" from the **Technical University Delft**, **The Netherlands**.

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 – 0745	*Registration & Coffee*
0745 – 0800	*Welcome & Introduction*
0800 – 0830	***PRE-TEST***
0830 – 0900	***General Introduction*** *Course Content ● Objectives of Course*
0900 – 0930	***Introduction to the World of Quality Measuring Instruments*** *Why, Where & What is Measurement & Analysis? ● Reference Standards ● Traceability ● Quality Assurance ● Response*
0930 – 0945	*Break*

0945 – 1030	***Measurement Accuracy & Quality Assurance*** *Quality Factors & Terminology ● Accuracy, Precision & Standard Deviation*
1030 – 1130	***Measurement Accuracy & Quality Assurance (cont'd)*** *Control Chart Tool ● Rules for intervention*
1130 – 1230	***Analyser Selection, Issues to be Considered, Analysing Problems & Best Practices***
1230 – 1245	*Break*
1245 – 1330	***Viscosity Measurement*** *Dynamic & Kinematic Viscosity ● Types of Liquid Viscosity ● Why Measuring Viscosity? ● Units & SAE System ● Measuring Principles Types of Lab & Online Viscometers ● New Development*
1330 – 1420	***Vapour Pressure Measurement*** *Significance & Definition ● Boiling Point ● Evaporation ● Reid & True VP ● Evaporation ● On-Line 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 One*

Day 2

0730 – 0830	***Analyzer Sampling & Conditioning*** *Process Analyzer Sampling & Conditioning ● Process Conditions ● Dead Volumes ● Engineering Issues ● Sample Lag Time ● Examples Sampling Systems ● Sample Recovery*
0830 – 0930	***Analyzing Instrumentation Problems*** *Trouble Shooting Issues ● Logical System Search ● Best Practices*
0930 – 0945	*Break*
0945 – 1230	***Principles of Gas Chromatography*** *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*
1230 – 1245	*Break*
1245 – 1420	***GC Detectors & Quantitation Methods*** *Thermal Conductivity Detector & Measurement ● Flame Ionization Detector ● Dynamic Range of Detectors ● Application of Make-Up Gas ● Electron Capture Detector ● Flame Photometric Detector ● Detector & Relative Response Factors ● Integration Methods ● Analysis Data Processing ● Standard Calibration Methods*
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

0730 – 0830	***Process GC Utilities*** *Choice for Type of Carrier Gas ● Filters ● Tubing & Regulators ● Pressure & Flow Control*

0830 – 0930	***Moisture Theory & Analysis*** *Dew Point/Frost Point ● Water Vapor Properties ● Dalton's Law ● Dew Point/Pressure Relationship ● Relative Humidity ● Psychrometric RH Measuring Method ● Moisture Analysis Methods ● SiO2 & AlOx Sensors*
0930 – 0945	*Break*
0945 – 1100	***Moisture Theory & Analysis (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*
1100 – 1230	***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*
1230 – 1245	*Break*
1245 – 1420	***Spectroscopic Analysis*** *Spectral Ranges ● Wavelength & Frequency ● Diffraction Methods ● AOTF Type Filter ● Types of Spectroscopy ● Lambert Beer's Law*
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

0730 – 0830	***Spectroscopic Analysis (cont'd)*** *Non Dispersive IR ● UV Spectrometry ● Principles of FTIR ● How Results are Obtained? ● FTIR Advantages/Disadvantages ● Raman Spectroscopy ● Stack Gas Quality Monitoring*
0830 – 0930	***pH Process Measurements*** *Reasons for pH Analysis ● Introduction to pH Measurements ● Construction of the Glass Measuring Electrode ● Types of pH Electrodes & their Application ● pH Measuring Circuit ● pH Measuring Principle & Nernst Equation ● Potentials Present in a pH Loop*
0930 – 0945	*Break*
0945 – 1030	***pH Process Measurements (cont'd)*** *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*
1030 – 1130	***Conductivity & TDS Measurement*** *Basic Construction of a Conductivity Cell ● Specific Conductivity ● Cell Constant ● Liquid Conductivity & TDS Ranges ● Application of Conductivity Measurements ● Conductivity Versus Concentration ● Relation Conductivity & TDS Measurement ● Principle Toroidal Conductivity Measurement ● Applied Type of Voltage & Polarization Effects ● Four Electrode Type Sensors ● Principle Difference Between the Type of Temperature Compensation pH & Conductivity ● A Factors of Common Type of Liquids ● High Conductivity Measurements*
1130 – 1230	*Break*

1230 – 1420	***Density & Coriolis Measurement*** *Density Properties ● Vibrating Density Meters ● Coriolis Principle ● Gamma/Nucleonic ● Specific Gravity ● Standardized Calculation Methods*
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

0730 – 0830	***Electrochemical Analysis*** *Principles of EC O2-Cell ● Basics of ORP Measurements ● Applications ● Standard H2 Electrode ● Nernst Equation ● Conclusions*
0830 – 0930	***Room for Delegate's Expected Process Analyse Subject*** *Options: H2S Analyser ● Dissolved Oxygen ● Water Cut Analysis ● Hardness & TOC Analysis ● Wobbe Index/Calorimeters*
0930 – 0945	*Break*
0945 – 1230	***Room for Delegate's Expected Process Analyse Subject (cont'd)*** *Options: H2S Analyser ● Dissolved Oxygen ● Water Cut Analysis ● Hardness & TOC Analysis*
1230 – 1245	*Break*
1245 – 1345	***Room for delegate's expected Process Analyse Subject (cont'd)*** *Options: H2S Analyser ● Dissolved Oxygen ● Water Cut Analysis ● Hardness & TOC Analysis (cont'd)*
1345 – 1400	***Review Session & Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions/Lab Visit

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

Course Coordinator

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