COURSE OVERVIEW TE0307
RO Technology

Course Title
ROTechnology

Course Date/Venue
Session 1: August 18-22, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: December 22-26, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
TE0307

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of RO Technology. It covers the principles of reverse osmosis, basic components of an RO system and applications of RO in water treatment; the water composition and properties affecting RO performance, types of impurities, water hardness and its impact on RO systems; the pre-treatment requirements and processes, RO membrane fundamentals, basic principles of osmosis, RO system design and basic operations and control; and the membrane cleaning techniques, monitoring membrane performance and membrane replacement strategies.

Further, the course will also discuss the role of pretreatment in RO systems and filtration methods, chemical dosing, anti-scalant application, pH adjustment and softening processes; the principles of energy recovery in RO, types of energy recovery devices and benefits of energy recovery in reducing operational costs; the maintenance and efficiency optimization of energy recovery devices; the post-treatment processes in RO systems and RO system monitoring, control and performance optimization.

During this interactive course, participants will learn the design of RO systems for different applications, calculating RO system recovery and salt rejection and the multi-stage and series RO systems; the economic analysis of RO systems, energy consumption and efficiency in RO and safety in RO system design; the RO technology in desalination, advanced membrane technology and innovations and wastewater reclamation using RO; the nanotechnology RO systems and environmental impact of RO systems; troubleshooting and problem-solving RO systems; and the membrane cleaning procedures and maintenance, data analysis and performance evaluation and best practices and industry standards for RO systems.

Course Objectives

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

- Apply and gain an in-depth knowledge on RO technology
- Discuss the principles of reverse osmosis, basic components of an RO system and applications of RO in water treatment
- Identify water composition and properties affecting RO performance, types of impurities, water hardness and its impact on RO systems and pre-treatment requirements and processes
- Explain RO membrane fundamentals, basic principles of osmosis, RO system design and basic operations and control
- Apply membrane cleaning techniques, monitoring membrane performance and membrane replacement strategies
- Discuss the role of pretreatment in RO systems and carryout filtration methods, chemical dosing and anti-scalant application and pH adjustment and softening processes
- Explain the principles of energy recovery in RO, identify the types of energy recovery devices and benefits of energy recovery in reducing operational costs and apply maintenance and efficiency optimization of energy recovery devices
- Carryout post-treatment processes in RO systems, RO system monitoring and control systems and RO system performance optimization
- Design RO systems for different applications, calculate RO system recovery and salt rejection and recognize multi-stage and series RO systems
- Apply economic analysis of RO systems, energy consumption and efficiency in RO and safety in RO system design
- Discuss RO technology in desalination, advanced membrane technology and innovations and wastewater reclamation using RO
- Determine nanotechnology in RO systems and environmental impact of RO systems as well as troubleshooting and apply problem-solving in RO systems
- Employ membrane cleaning procedures and maintenance, data analysis and performance evaluation and best practices and industry standards for RO systems

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 RO technology for water treatment plant operators and technicians, process engineers and system designers, maintenance personnel, environmental and water quality specialists, utility and facility managers, project managers and consultants, industrial plant personnel and those who involved in water treatment and desalination processes, particularly those working with reverse osmosis (RO) systems.

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.

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. Kyle Bester is a **Senior Water Engineer** with extensive years of practical experience within the **Oil & Gas**, **Power & Water Utilities** and other **Energy** sectors. His expertise includes **Water Reservoir**, **Water Tanks**, **Water Pumping** Station, **Water Distribution** System, **Water Network** System, **Water Pipes & Fittings**, **Water Hydraulic** Modelling, **Water Storage Reservoir**, **Reservoirs & Pumping** Stations Design & Operation, **Pumping** Systems, Interconnecting **Pipelines**, **Water Network Hydraulic** Simulation Modelling, **Water Supply** Design, **Water Balance Modelling**, **Water Distribution Network**, **Water Network** System Analysis, **Water Forecasts** Demand, **Water Pipelines** Materials & Fittings, **Water Network** System Design, Pump Houses & Booster Pumping Stations, **Potable Water Transmission**, **Water Distribution Network**, Districts Meters Areas (DMAs), **Water Supply & Desalination Plants** Rehabilitation, **Water Reservoirs & Pumping Stations**, **Water Network System** Extension, Water Network System Replacement & Upgrade, **Water Networks** Optimization, **Water Supply & Distribution** Systems Efficiency & Effectiveness, **Pipe** Materials & Fittings, **Service Reservoir** Design & Operation, **Pipes & Fittings**, **Water Network** System Design & Operation, **Supply Water Network** Rehabilitation, **Water Loss** Reduction, **Main Water** System Construction, **Main Water Line** Construction, Transmission & Distribution **Pipelines**, **Water Distribution** Design & Modelling, **Water Supply** System, Oilfield **Water Treatment**, Best Practice in **Sewage** & Industrial **Wastewater Treatment** & Environmental Protection, **Water Distribution** Design & Modelling, **Desilting**, Treating & Handling Oily **Water**, **Water Chemistry** for **Power Plant**, **Water** Sector Orientation, Environmental Impact Assessment (**EIA**), **Potable Water**, **Reverse Osmosis** Treatment Technology and **Chlorination** System, **Well** Inventory, Monitoring & Conservation, **Qualitative Analysis** of Soil & Ground Water, **Water** Networking, **Hydraulic Modelling** Systems, **Pumping** Stations, **Centrifugal Pumps**, **Pipelines & Pumping**, **Water Reservoirs**, **Water Storage Tanks**, Extended Activated **Sludge** Treatment, **Sewage & Industrial Wastewater** Treatment & Environmental Protection, Supervising & Monitoring **Sewage Works**, **Water Desalination** Technologies, **Water Distribution & Pump** Station, Best **Water Equipment** Selection & Inspection, **Hydraulic Modelling** for Water Network Design, **Water Utility** Industry, **Water Desalination** Technologies & New Development, **Water Hydrology**, **Water Conveyors**, **Water Networks** Rehabilitation. He is currently the **Part Owner & Manager** of Extreme Water SA wherein he manages, re-designed and commissioned a water and wastewater treatment plants.

During his career life, Mr. Bester has gained his practical and field experience through his various significant positions and dedication as the **Project Manager**, **Asset Manager**, **Manager**, **Water Engineer**, **Supervisor**, **Team Leader**, **Analyst**, **Process Technician**, **Landscape Designer** and **Senior Instructor/Trainer** for various international companies, infrastructures, water and wastewater treatment plants from New Zealand, UK, Samoa, Zimbabwe and South Africa, just to name a few.

Mr. Bester holds a **Diploma** in **Wastewater Treatment** and a **National Certificate** in **Wastewater & Water Treatment**. Further, he is a **Certified Instructor/Trainer**, an **Approved Chemical Handler** and has delivered numerous courses, trainings, conferences, seminars and workshops internationally.

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

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of RO Technology*** *Definition and Principles of Reverse Osmosis • Basic Components of an RO System (Membranes, Pumps, Pressure Vessels) • Comparison with Other Water Treatment Methods • Applications of RO in Water Treatment*
0930 – 0945	*Break*
0945 – 1030	***Water Chemistry for RO Systems*** *Water Composition and Properties Affecting RO Performance • Types of Impurities (Dissolved Solids, Organic Materials, Bacteria) • Water Hardness and its Impact on RO Systems • Pre-Treatment Requirements and Processes*
1030 – 1130	***RO Membrane Fundamentals*** *Types of RO Membranes (Thin Film Composite, Cellulose Acetate) • Membrane Structure and Functionality • Membrane Fouling and Scaling • Factors Affecting Membrane Performance (Temperature, Pressure, Flow)*
1130 – 1215	***Basic Principles of Osmosis*** *Osmotic Pressure and Driving Force in RO • Concentration Polarization • Understanding Salt Rejection Rates • Membrane Permeability and Selectivity*
1215 – 1230	*Break*

1230 – 1330	***RO System Design*** *Components of an RO System (Feedwater Pump, Membranes, Recovery System) • Process Flow Diagram of RO System • RO System Configurations (Single-Stage, Multi-Stage, Pressure Vessels) • Design Parameters (Recovery Rate, Feed Water Quality, Permeate Flow)*
1330 – 1420	***Basic Operations & Control*** *Start-Up and Shutdown Procedures • Normal Operating Conditions (Pressure, Flow, Temperature) • Control Systems and Instrumentation • Common Operational Issues and Troubleshooting*
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	***RO Membranes & their Maintenance*** *Membrane Cleaning Techniques (Chemical Cleaning, Backflushing) • Common Types of Fouling and Methods to Address them • Monitoring Membrane Performance (Flux, Pressure Drop) • Membrane Replacement Strategies*
0830 – 0930	***Pretreatment Systems for RO*** *Role of Pretreatment in RO Systems • Filtration Methods (Sand Filters, Carbon Filters, Microfiltration) • Chemical Dosing and Anti-Scalant Application • pH Adjustment and Softening Processes*
0930 – 0945	*Break*
0945 – 1100	***Energy Recovery Devices in RO Systems*** *Principles of Energy Recovery in RO • Types of Energy Recovery Devices (Pressure Exchangers, Turbochargers) • Benefits of Energy Recovery in Reducing Operational Costs • Maintenance and Efficiency Optimization of Energy Recovery Devices*
1100 – 1215	***Post-Treatment Processes in RO Systems*** *Mineralization and Stabilization of Permeate Water • UV Disinfection and Filtration • pH Adjustment After RO Treatment • Post-Treatment for Specific End-Use Requirements (Drinking Water, Industrial Applications)*
1215 – 1230	*Break*
1230 – 1330	***RO System Monitoring & Control Systems*** *Online Monitoring Systems (Pressure, Flow, TDS, Temperature) • SCADA Systems Integration for RO Plants • Alarm Systems for RO Process Deviation • Data Logging and Performance Analysis*
1330 – 1420	***RO System Performance Optimization*** *Maximizing Recovery Rates without Compromising Water Quality • Managing Concentrate Disposal (Zero Liquid Discharge, Brine Management) • Optimizing System Efficiency Through Automation and Controls • Best Practices for System Operation and Efficiency*
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	***Designing RO Systems for Different Applications*** *Industrial versus Municipal RO System Design • Sizing RO Systems for Various Water Qualities (Brackish, Seawater) • Factors Influencing System Design (Flow Rate, Salt Content, Operational Goals) • Detailed Design Considerations (Feedwater Specifications, Recovery, Efficiency)*
0830 – 0930	***Calculating RO System Recovery & Salt Rejection*** *Recovery Ratio Calculation • Salt Rejection Capacity of RO Membranes • Estimating Permeate Quality Based on Feedwater Composition • Impact of Recovery Rate on System Performance*
0930 – 0945	*Break*
0945 – 1100	***Multi-Stage &Series RO Systems*** *Design Principles of Multi-Stage RO Systems • Applications of Series RO Systems (Brine Concentration, High Purity Water) • Challenges in Designing Multi-Stage Systems • Efficiency versus Cost Considerations in Multi-Stage Designs*
1100 – 1215	***Economic Analysis of RO Systems*** *Cost Factors in RO System Installation (Capital, Operational, Maintenance) • Lifetime Cost Estimation for Membranes and Components • Operating Cost Reduction Strategies (Energy Recovery, Automated Controls) • Return on Investment (ROI) Calculations for RO Systems*
1215 – 1230	*Break*
1230 – 1330	***Energy Consumption &Efficiency in RO*** *Calculating Energy Consumption in RO Systems • Energy-Saving Strategies in RO System Design • Role of Pumps and Pressure in Energy Efficiency • Comparison of Energy-Efficient RO Technologies*
1330 – 1420	***Safety in RO System Design*** *Ensuring Compliance with Health and Safety Regulations • Handling of Chemicals and Cleaning Agents • Safety Protocols During System Operation and Maintenance • Emergency Procedures and Safety Equipment*
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	***RO Technology in Desalination*** *Overview of Desalination Using RO (Seawater Desalination) • Design Considerations for Seawater RO Plants • Challenges in Seawater Desalination (Scaling, Fouling, Energy Consumption) • Case Studies of Large-Scale Seawater Desalination Projects*
0830 – 0930	***Advanced Membrane Technology &Innovations*** *Development of Next-Generation RO Membranes • Hybrid Systems Combining RO with Other Technologies (Electrodialysis, Nanofiltration) • Membrane Surface Modifications to Enhance Performance • Future Trends in Membrane Technology*
0930 – 0945	*Break*
0945 – 1100	***Wastewater Reclamation Using RO*** *Applications of RO in Water Recycling and Wastewater Treatment • Design of RO Systems for Tertiary Wastewater Treatment • Water Reuse Standards and Regulations • Case Studies on Wastewater Reclamation*

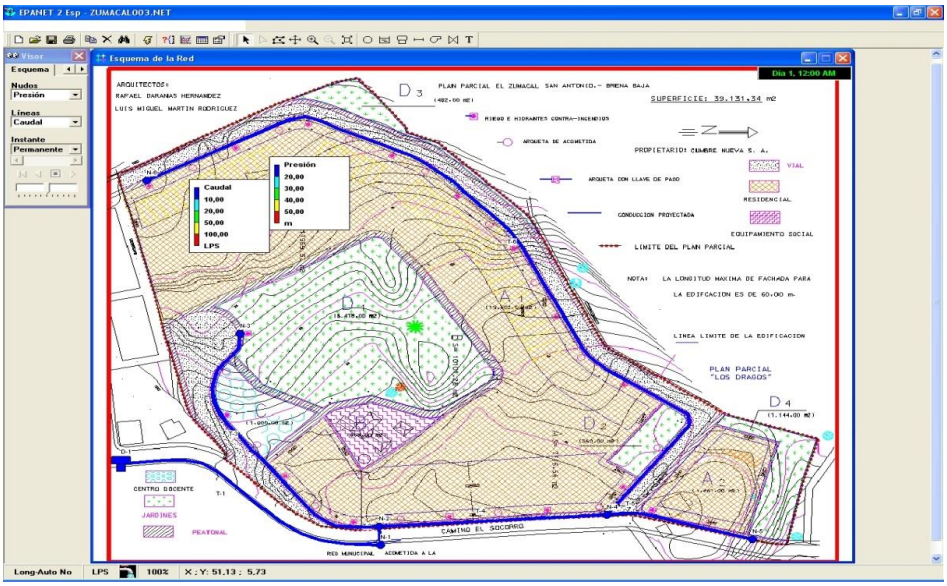
1100 – 1215	***Nanotechnology in RO Systems*** *Role of Nanomaterials in Improving RO Efficiency • Application of Nanofilters and Advanced Coatings • Future Prospects for Nanotechnology in Water Treatment • Environmental Impact of Nanotechnology in RO*
1215 – 1230	*Break*
1230 – 1330	***Environmental Impact of RO Systems*** *Minimizing Brine Disposal Issues and Environmental Impact • Sustainability Considerations in RO System Operations • Water-Energy Nexus in Desalination Processes • Green RO Technologies and Eco-Friendly Practices*
1330 – 1420	***Troubleshooting & Problem-Solving in RO Systems*** *Common Operational Issues and Troubleshooting Techniques • Identifying Membrane Fouling Causes and Solutions • Corrective Actions for Low Permeate Flow or Quality • Case Studies of Real-World RO System Failures*
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	***Hands-On Training: RO System Start-Up &Operation*** *Practical Training on Starting Up an RO System • Monitoring Key Parameters During Operation • Adjusting Operating Conditions for Optimized Performance • Hands-On Exercises in System Troubleshooting*
0830 – 0930	***Membrane Cleaning Procedures &Maintenance*** *Practical Demonstration of Membrane Cleaning Techniques • Step-by-Step Cleaning Protocols (Chemical Cleaning, Rinsing) • Monitoring the Effectiveness of Cleaning Operations • Preventive Maintenance Tasks for Ensuring System Longevity*
0930 – 0945	*Break*
0945 – 1100	***Data Analysis & Performance Evaluation*** *Analyzing System Performance Data from SCADA Systems • Performance Benchmarking and Identifying Areas for Improvement • Case Study of System Optimization through Data Analysis • Creating Performance Reports and Maintenance Schedules*
1100 – 1215	***RO System Failure &Recovery Scenarios*** *Case Study of RO System Failure and How it Was Addressed • Identifying Root Causes of Operational Issues • Discussing Corrective Actions Taken in Emergency Situations • Lessons Learned from Real-World Failures and Best Practices*
1215 – 1230	*Break*
1230 – 1345	***Best Practices &Industry Standards for RO Systems*** *Industry Standards (ISO, WHO, and Local Water Quality Standards) • Global Best Practices for RO Technology Applications • Case Studies from Leading RO Plants Around the World • Sustainability Practices in RO Operations*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t 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 the latest revision of “EPANET” simulators.



EPANET Simulator

Course Coordinator

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