COURSE OVERVIEW PE0457
Mass Transfer & Separation Technology

Course Title
Mass Transfer & Separation Technology

Course Date/Venue
August 25-29, 2024/Oryx Meeting Room, Doubletree by Hilton Doha-Al Sadd, Doha, Qatar or Online Virtual Training

Course Reference
PE0457

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

Course Description

This practical and highly-interactive course includes real-life case studies 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 Mass Transfer and Separation Technology. It covers the role of mass transfer in gas and liquid handling and processing and Its Importance in pipeline; the principles of diffusion and convection in mass transfer; the various separation methods used in the industry; the distillation fundamentals including binary distillation and McCabe-Thiele method for stage calculations; the principles, equipment types and design considerations of absorption and stripping; the formation, prevention strategies and impact of gas hydrates in pipelines; and the key differences from binary distillation, azeotropic and extractive distillation.

Further, the course will also discuss the vacuum distillation techniques and reactive distillation; the types of packings column design and operation; troubleshooting common distillation problems; the basics of solvent extraction; the design of extraction equipment covering mixer-settlers, centrifugal extractors and column extractors; the membrane technology, reverse osmosis and ultrafiltration and gas separation membranes; and the cryogenic separation application in natural gas liquefaction and oxygen/nitrogen production.

During this interactive course, participants will learn the adsorption techniques, electrostatic separation, thermal techniques and management of separation units; the environmental and safety aspects handling toxic and flammable materials and emissions control on environmental; the advancements in separation materials and techniques like MOFs and advanced ceramics; and integrating IoT in separation processes including real-time monitoring and predictive maintenance.

Course Objectives

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

- Apply and gain an in-depth knowledge on mass transfer and separation technology
- Discuss the role of mass transfer in gas and liquid handling and processing and Its Importance in pipeline
- Identify the principles of diffusion and convection in mass transfer as well as the various separation methods used in the industry
- Explain distillation fundamentals including binary distillation and McCabe-Thiele method for stage calculations
- Identify the principles, equipment types and design considerations of absorption and stripping
- Discuss the formation, prevention strategies and impact of gas hydrates in pipelines
- Identify the key differences from binary distillation, azeotropic and extractive distillation
- Apply vacuum distillation techniques and reactive distillation and recognize the types of packings column design and operation
- Troubleshoot common distillation problems and discuss the basics of solvent extraction
- Illustrate the design of extraction equipment covering mixer-settlers, centrifugal extractors and column extractors
- Discuss membrane technology, reverse osmosis and ultrafiltration and gas separation membranes
- Carryout cryogenic separation application in natural gas liquefaction and oxygen/nitrogen production
- Implement adsorption techniques, electrostatic separation, thermal techniques and management of separation units
- Recognize the environmental and safety aspects, handling toxic and flammable materials and emissions control on environmental
- Identify the advancements in separation materials and techniques like MOFs and advanced ceramics
- Integrate IoT in separation processes including real-time monitoring and predictive maintenance

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 mass transfer and separation technology for engineers, chemists, managers and other technical staff who will maximize profitability by optimizing performance of separation processes in the chemical, petrochemical, petroleum, pharmaceutical, food and paper industries.

Virtual Training (If Applicable)

If this course is delivered online as a Virtual Training, the following limitations will be applicable:-

Certificates	Only soft copy certificates will be issued to participants through Haward's Portal. This includes Wallet Card Certificates if applicable
Training Materials	Only soft copy Training Materials (PDF format) will be issued to participant through the Virtual Training Platform
Training Methodology	80% of the program will be theory and 20% will be practical sessions, exercises, case studies, simulators or videos
Training Program	The training will be for 4 hours per day starting at 0930 and ending at 1330
H-STK Smart Training Kit	Not Applicable
Hands-on Practical Workshops	Not Applicable
Site Visit	Not Applicable
Simulators	Only software simulators will be used in the virtual courses. Hardware simulators are not applicable and will not be used in Virtual Training

Course Fee

F2F Classroom: **US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Online Virtual: **US$ 3,000** per Delegate.

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:

F2F Classroom: Mr. Mervyn Frampton

Mr. Mervyn Frampton is a **Senior Process Engineer** with over **30 years** of industrial experience within the **Oil & Gas**, **Refinery**, **Petrochemical** and **Utilities** industries. His expertise lies extensively in the areas of **Mass Transfer & Separation Technology**, **Process Troubleshooting**, **Distillation Towers**, **Fundamentals of Distillation** for Engineers, **Distillation** Operation and Troubleshooting, **Advanced Distillation** Troubleshooting, **Distillation** Technology, Vacuum **Distillation**, **Distillation Column** Operation & Control, **Oil Movement** Storage & Troubleshooting, **Process Equipment** Design, Applied **Process Engineering** Elements, **Process Plant** Optimization, **Revamping & Debottlenecking**, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant** Monitoring, **Catalyst** Selection & Production Optimization, Operations Abnormalities & Plant Upset, **Process Plant** Start-up & Commissioning, **Clean Fuel** Technology & Standards, Flare, Blowdown & Pressure Relief Systems, **Oil & Gas Field Commissioning** Techniques, **Pressure Vessel** Operation, **Gas Processing**, **Chemical** Engineering, **Process Reactors** Start-Up & Shutdown, **Gasoline Blending** for Refineries, **Urea Manufacturing** Process Technology, Continuous Catalytic Reformer (**CCR**), **De-Sulfurization** Technology, Advanced Operational & Troubleshooting Skills, Principles of Operations Planning, **Rotating Equipment** Maintenance & Troubleshooting, **Hazardous Waste Management & Pollution Prevention**, **Heat Exchangers & Fired Heaters** Operation & Troubleshooting, **Energy Conservation** Skills, **Catalyst Technology**, **Refinery & Process Industry**, **Chemical Analysis**, **Process Plant**, **Commissioning & Start-Up**, **Alkylation**, **Hydrogenation**, **Dehydrogenation**, **Isomerization**, **Hydrocracking & De-Alkylation**, **Fluidized Catalytic Cracking**, **Catalytic Hydrodesulphuriser**, **Kerosene Hydrotreater**, **Thermal Cracker**, **Catalytic Reforming**, **Polymerization**, **Polyethylene**, **Polypropylene**, Pilot Water Treatment Plant, **Gas Cooling**, **Cooling Water Systems**, Effluent Systems, Material Handling Systems, **Gasifier**, **Gasification**, Coal Feeder System, **Sulphur Extraction Plant**, **Crude Distillation Unit**, **Acid Plant Revamp** and **Crude Pumping**. Further, he is also well-versed in HSE Leadership, Project and Programme Management, Project Coordination, Project Cost & Schedule Monitoring, Control & Analysis, Team Building, Relationship Management, Quality Management, Performance Reporting, Project Change Control, Commercial Awareness and Risk Management.

During his career life, Mr. Frampton held significant positions as the **Site Engineering Manager**, **Senior Project Manager**, **Process Engineering Manager**, **Project Engineering Manager**, **Construction Manager**, **Site Manager**, **Area Manager**, **Procurement Manager**, **Factory Manager**, **Technical Services Manager**, **Senior Project Engineer**, **Process Engineer**, **Project Engineer**, **Assistant Project Manager**, **Handover Coordinator** and **Engineering Coordinator** from various international companies such as the **Fluor Daniel**, **KBR** South Africa, **ESKOM**, MEGAWATT PARK, CHEMEPIC, PDPS, CAKASA, **Worley Parsons**, Lurgi South Africa, **Sasol**, **Foster Wheeler**, **Bosch** & **Associates**, **BCG** Engineering Contractors, Fina Refinery, Sapref Refinery, Secunda Engine Refinery just to name a few.

Mr. Frampton has a **Bachelor's degree** in **Industrial Chemistry** from **The City University** in **London**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**) and has delivered numerous trainings, courses, workshops, conferences and seminars internationally.

OR,

Online Virtual Training: Dr. Faysal Eliyan

Dr. Faysal Eliyan, PhD, MSc, BSc, is a **Senior Engineer** with extensive years of experience within the **Oil & Gas**, **Petroleum** and **Refinery** industries. His expertise widely covers in the areas of **De-Sulfurization Technology**, **Process Plant** Equipment, **Process Equipment Design**, Sizing, Selection, Applications & Troubleshooting, **Mass Transfer & Separation Technology**, **Process Plant Optimization** Technology & Continuous Improvement, **Plant Operation**, **Troubleshooting & Optimization**, **Gas Conditioning & Processing**, **Plant Layout Optimization**, **Concrete Structural Design**, **Concrete Maintenance & Reliability Analysis**, **Civil Engineering** Drawings, Standards & Codes, **Civil Engineering** Design, Petrochemical Plant Structure Design & Remediation, Elements of **Applied Civil Engineering**, **Dynamic Analysis of Rotating Equipment** Foundations **& Structural Steel Piperacks**, **Concrete & Structural Steel Design**, **Steel Structure Design**, Advanced **Building Construction Technology**, **Structural Engineering** Techniques, **Structural Renovation of Buildings**, **Earthwork & Structural Maintenance**, **Surface Drainage**, **Drainage System**, **Building Envelopes & Finishes**, **Landscaping & Roofing** System, **Seismic Design** for Buildings, **AutoCAD**, Advanced **Seismic & Wind Design of Reinforced Concrete**, **Structural** Systems & Components, Design of **Concrete Columns & Beam Frames**, Design of **Foundations & Equipment Footings**, **Maintenance of Concrete Structure**s, **Structural Reliability Assessment**, **Codes & Structural Reliability**, Probabilistic Evaluation of Existing Structures, **Structural Steel**, **Precast Concrete** and **Reinforced Polymer Layered Steel**. Further, he is also well-versed in **Gas Turbines**, **Steam Turbines, Heat Exchangers** Inspection, Testing & Overhaul Cleaning, Heating, Ventilation & Air Conditioning (**HVAC**), **Fans & Blowers**, **Heaters** & **Boilers**, **Compressors**, **Maintenance Planning & Scheduling**, **Pumps & Compressors** Operation & Maintenance, **Valves Technology** Selection, Installation & Troubleshooting, **Cooling Towers**, **Rotating Equipment**, **Turbomachinery**, **Condition Monitoring** & **Diagnostics**, **Hydraulic** & **Pneumatic Systems** Maintenance & Troubleshooting, **Piping Systems**, **Corrosion Control** & **Materials Selection** in Oil and Gas and Water Systems, **Machinery Alignment** & **Balancing**, **Maintenance Management**, **Operational Problems & Failure Analysis**, **Energy Performance Assessment** of **Powerplants**, **Plant Operations**, **Project Management**, **Six Sigma** and **Health**, **Safety** & **Environment**.

During his career life, Dr. Faysal has gained his practical and field experience through his various significant positions and dedication as the **Assistant Professor**, **Senior Consultant**, **Laboratory Instructor**, **Lecturer**, **Tutor**, **Mentor**, **Advisor**, **Trainer**, **Engineering Manager**, **Senior Engineer**, **Senior Project Engineer**, **Engineer** and **Adjudicator** from various institutions and universities such as the Community College of Qatar, American University of the Middle East, McMaster University, The University of British Columbia, The University of British Columbia, Qatar University and General Electric, just to name a few.

Dr. Faysal has **PhD**, **Master** and **Bachelor** degrees in **Engineering** from the **University of British Columbia** (**Canada**). He is a **Certified Instructor/Trainer**, a member of the **Chamber of Civil Engineers**, **Structural Stability Research Council**, **American Institute of Steel Construction** and **American Society of Civil Engineers** (**ASCE**), **USA**. He also **published numerous books**, **researches** and **scientific papers** and received several awards and recognitions for **Journal of Materials Engineering and Performance** and has further delivered numerous trainings, courses, seminars, workshops and conferences 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.

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: ***Sunday, 25th of September 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Mass Transfer & Its Importance in Pipeline Operations:*** *Understanding the Role of Mass Transfer in Gas & Liquid Handling & Processing*
0930 – 0945	*Break*
0945 – 1030	***Principles of Diffusion & Convection in Mass Transfer:*** *Differentiating Between Molecular & Eddy Diffusion, Fick's Laws of Diffusion*
1030 – 1130	***Separation Technologies:*** *Overview of Various Separation Methods Used in the Industry*
1130 – 1215	***Distillation Fundamentals:*** *Basic Principles, Binary Distillation, McCabe-Thiele Method for Stage Calculations*
1215 – 1230	*Break*
1230 – 1330	***Absorption & Stripping:*** *Principles, Equipment Types & Design Considerations*
1330 – 1420	***Gas Hydrates in Pipelines:*** *Formation, Prevention Strategies & Impact on Pipeline Flow*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2: ***Monday, 26th of September 2024***

0730 – 0830	***Multicomponent Distillation:*** *Key Differences from Binary Distillation, Methods for Handling Multicomponent Feeds*
0830 – 0930	***Azeotropic & Extractive Distillation:*** *Handling & Separation of Azeotropes, Solvent Selection & Process Design*
0930 – 0945	*Break*
0945 – 1100	***Vacuum Distillation Techniques:*** *Application in Heavy Fraction Separation, Design & Operational Considerations*
1100 – 1215	***Reactive Distillation:*** *Integration of Reaction & Separation in a Single Unit, Case Studies & Applications*

1215 – 1230	Break
1230 – 1330	***Packed Column Design & Operation:*** Types of Packings, Design Methodology, Pressure Drop & Efficiency Considerations
1330 – 1420	***Troubleshooting Common Distillation Problems:*** Flooding, Weeping & Other Operational Issues
1420 – 1430	***Recap***
1430	Lunch & End of Day Two

Day 3: Tuesday, 27th of September 2024

0730 – 0830	***Basics of Solvent Extraction:*** Principles, Solvent Selection & Extraction Efficiencies
0830 – 0930	***Design of Extraction Equipment:*** Mixer-Settlers, Centrifugal Extractors & Column Extractors
0930 – 0945	Break
0945 – 1100	***Membrane Technology:*** Types of Membranes, Applications in Gas & Liquid Separations
1100 – 1215	***Reverse Osmosis & Ultrafiltration:*** Principles, Applications & Maintenance of Systems
1215 – 1230	Break
1230 – 1330	***Gas Separation Membranes:*** Application in Natural Gas Processing, Hydrogen Recovery
1330 – 1420	***Practical Exercises on Membrane System Design:*** Design Calculations & Case Studies
1420 – 1430	***Recap***
1430	Lunch & End of Day Three

Day 4: Wednesday, 28th of September 2024

0730 – 0830	***Cryogenic Separation:*** Application in Natural Gas Liquefaction & Oxygen/Nitrogen Production
0830 – 0930	***Adsorption Techniques:*** Materials, Isotherms & Cycles in Pressure Swing Adsorption (PSA)
0930 – 0945	Break
0945 – 1100	***Electrostatic Separation:*** Principles & Applications in Desalting & Particle Separation
1100 – 1215	***Thermal Techniques:*** Sublimation & Freeze Drying Principles & Applications
1215 – 1230	Break
1230 – 1330	***Management of Separation Units:*** Energy Efficiency, Integration & Optimization Strategies
1330 – 1420	***Environmental & Safety Aspects:*** Handling Toxic & Flammable Materials, Emissions Control
1420 – 1430	***Recap***
1430	Lunch & End of Day Four

Day 5: Thursday, 29th of September 2024

0730 – 0830	***Case Study:*** Design of a Natural Gas Dehydration Unit: Using Glycol Absorption
0830 – 0930	***Case Study:*** CO2 Capture & Storage: Technologies, Solvents & Operational Issues
0930 – 0945	Break

0945 – 1100	***Advancements in Separation Materials & Techniques:*** *New Materials Like MOFs, Advanced Ceramics*
1100 – 1230	***Integration of IoT in Separation Processes:*** *Real-Time Monitoring, Predictive Maintenance*
1230 – 1245	*Break*
1245 – 1345	***Workshop on Troubleshooting & Optimization:*** *Group Activity Based on Real-World Problems*
1345 – 1400	***Course Conclusion***
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

Jaryl Castillo, Tel: +974 4423 1327, Email: jaryl@haward.org