COURSE OVERVIEW PE0660-4D
Rules of Thumb in the Design of Process Equipment

Course Title
Rules of Thumb in the Design of Process Equipment

Course Reference
PE0660-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	September 09-12, 2024	Club B Meeting Room, Ramada Plaza by Wyndham Istanbul City Center, Istanbul, Turkey
2	December 16-19, 2024	Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

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.

Chemical Engineers are at the forefront of creating and developing processes and products. They are operating at the leading edge of technology and they are the minds and backbone of the process industry. All engineers, in general, employ mathematics, physics and the engineering art to overcome technical problems in a safe and economical fashion. Yet, it is the chemical engineer alone that draws upon the vast and powerful science of chemistry to solve a wide range of problems. The strong technical and social ties that bind chemistry and chemical engineering are unique in the fields of science and technology. The breadth of scientific and technical knowledge inherent in the profession has caused some to describe the chemical engineer as the "Universal Engineer". Despite a title that suggests a profession composed of narrow specialists, chemical engineers are actually extremely versatile and able to handle a wide range of technical problems.

The rule of thumb is defined as "a rough guestimate measure, practice or experience, as distinct from theory". Engineers need such rules of thumb to guide decisions, set goals and check results. Some believe that providing a collection of rules of thumb is dangerous because engineers might forsake the fundamentals and place too much emphasis on order-of-magnitude estimates. However, it was found for problem solving in industry, for design, for process improvement and for troubleshooting that rule of thumb are not dangerous but they are very essential.

This course is designed to provide chemical and process engineers with a lot of common-sense techniques, shortcuts and calculations to quickly and accurately solve day-to-day design, operations and equipment problems. The practical tips, handy formulas, correlations, curves, charts, tables, and shortcut methods presented in this course will save engineers valuable time and effort. This course covers rules of thumb applicable to Fluid flow, Heat exchangers, Fractionators, Absorbers, Pumps, Drivers, Separators/accumulators, Boilers & Cooling towers.

Course Objectives

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

- Apply the rules of thumb in the design of process equipment
- Employ the rules of thumb for heat exchangers and command the TEMA standards and selection guides
- Perform rules of thumb for fractionators & absorbers and explain their design, control schemes & optimization techniques
- Use the rules of thumb for pumps including affinity laws, horsepower, efficiency minimum flow & suction system and recognize the various construction materials used in pumps
- Implement the rules of thumb for drivers and determine their ranges of application, efficiency & service factors
- Apply rules of thumb for separators/accumulators such as liquid & vapour residence time, calculation methods, pressure drop, vessel thickness, gas scrubbers & reflux drums and employ the general vessel design tips
- Carryout the rules of thumb for boilers and acquire knowledge on thermal efficiency, stack gas enthalpy & quantity, steam drum stability, blowdown control, caustic embrittlement, etc
- Perform rules of thumb for cooling towers and analyze its system balances, temperature data & transfer units

Who Should Attend

This course provides an overview of all significant aspects and considerations of rules of thumb in the design of process equipment for engineers, supervisors, plant and shift foremen and other technical staff.

Exam Eligibility & Structure

- Exam Candidates shall have the following minimum prerequisites: -
  Participants must have a good understanding of the chemical engineering basic principles of operations and process equipment.

Course Fee

Istanbul	**US$ 5,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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 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 **2.4 CEUs** (Continuing Education Units) or **24 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.

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. Robert Harvey, MSc (Cum Laude), BSc is a **Senior Chemical Engineer** with over **45 years** of in-depth industrial experience within the **Oil & Gas**, **Refinery**, **Petrochemical**, **Mining** and **Power** industries. His expertise widely covers in the areas of **Fertilizer Manufacturing** Process Technology, **Fertilizer Storage** Management (Ammonia & Urea), **Petrochemical & Fertilizer** Plants, **Nitrogen Fertilizer** Production, **Petroleum Industry Process** Engineering, **Process Equipment** Design & Troubleshooting, **Process Equipment & Piping Systems**, **Fertilizer** Manufacturing Process Technology, **Production** Management, **Process Plant** Optimization & Continuous Improvement, **Revamping & Debottlenecking**, **Pressure Vessel** Operation, **Heat Mass Balance**, **Distillation-Column** Operation, & Troubleshooting, **Production Process** Optimization, **Debottlenecking**, **Unit Performance** Optimization, **Process Analyzers**, Real Time Online Optimization, **Operations Planning** Optimization, **Engineering Problem Solving**, **Bag Filters** Operation & Maintenance, **Process Equipment** Design, Chemical Reaction Engineering Application, **Phosphatic Industry**, **Diammonium Phosphate**, **Monoammonium Phosphate**, **NPK**, Troubleshooting Improvement, **Production** Management, **Distillation-Column** Operation & Troubleshooting, Vinyl Chloride Monomer (**VCM**) Manufacturing & Process Troubleshooting, **Monomer** Handling Safety, **Cement** Manufacturing Process Technology & Standards, Complex Operational Troubleshooting, Incident **Root Cause Analysis** & Corrective Action, **Process Equipment & Piping** System, **Fertilizer** Manufacturing, **Process Plant** Optimization & Continuous Improvement, **Process Plant** Performance & Efficiency, Continuous Improvement & Benchmarking, **Energy Efficiency** for Process Plants, **Pressure Vessel** Operation, **Reactors & Storage Tanks**, Dehydrating Columns, Heat & Material Balance, **Troubleshooting Process Operations**, Modern **Aluminium Production Processes**, **Cement Kiln Process**, **Process Engineer Calculations**, Steel Making Process, **P&ID** Reading & Interpretation, **Detailed Engineering Design**, **Process Diagrams** Review, Process Hazard Analysis (**PHA**), **HAZOP** Leadership, Project HSE Review (**PHSER**), Safe Handling of **Propylene Oxide & Ethylene Oxide**, Safety in **Process & Industrial Plants**, Environmental Impact Assessment (**EIA**) and Effective **Risk Assessment & HAZOP** Studies. Further, he is also well versed in Feasibility Studies Analysis & Evaluation, Project Gate System Procedures, Process Mapping, Change Management Skills, Change Management Strategy, Strategical Process Control in Process Industry, Developing Commercial Contracts, Project Management Skills, Project Scheduling & Cost Control, FIDIC & Other Model Contracts, EPC & EPCM Contracts, Knowledge Management, Job Evaluation, Creative Problems Solving & Innovation Skills, Problem Solving & Decision Making, Strategic Planning & Creative Thinking and Mind Mapping.

During his career life, Mr. Harvey has gained his practical and field experience through his various significant positions and dedication as the **Commercial Director**, **Manufacturing Director**, **Chief Operating Officer**, **Head Projects Division**, **Project Leader**, **Lead Technical Advisor/Consultant** and **Project Consultant** to various international companies such as the Trade and Industrial Policy Strategies (TIPS), PGBI Johannesburg, IDC Green Industries SBU/Arengo 316 Pty Ltd, Ferrum Crescent Limited, CEF Limited, Rio Tinto Alcan, Industrial Development Corporation of SA (IDC) and AECI Limited.

Mr. Harvey has **Master's** (**Cum Laude**) and **Bachelor's** degrees in **Chemical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and has delivered various trainings, seminars, conferences, workshops and courses globally.

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 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Introduction*** *Optimum Design • Rule of Thumb - Definition*
0900 – 0930	***Fluid Flow*** *Energy Relationships • Velocity Head • Piping Pressure Drop • Equivalent Length • Recommended Velocities • Two-phase Flow*
0930 - 1000	***Fluid Flow (cont'd)*** *Compressible Flow-Short Pipeline • Compressible Flow-Long Pipelines • Sonic Velocity • Metering • Control Valves • Safety Relief Valves*
1000 – 1015	*Break*
1015 – 1230	***Heat Exchangers*** *TEMA • Selection Guides • Pressure Drop Shell and Tube • Temperature Difference • Shell Diameter • Shell Velocity Maximum • Nozzle Velocity Maximum • Heat Transfer Coefficients*
1230 – 1245	*Break*
1245 – 1420	***Heat Exchangers (cont'd)*** *Fouling Resistances • Metal Resistances • Vacuum Condensers • Air-Cooled Heat Exchangers: Forced vs Induced Draft • Air-Cooled Heat Exchangers: Pressure Drop Air Side • Air-Cooled Heat Exchangers: Rough Rating • Air-Cooled Heat Exchangers: Temperature Control • Miscellaneous Rules of Thumb*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Fractionators*** *Relative Volatility • Minimum Reflux • Minimum Stages • Actual Reflux and Actual Theoretical Stages • Reflux to Feed Ratio • Actual Trays • Graphical Methods • Tray Efficiency • Diameter of Bubble Cap Trays • Diameter of Sieve/Valve Trays (F Factor)*
0930 – 0945	*Break*
0945 – 1100	***Fractionators (cont'd)*** *Diameter of Sieve/Valve Trays (Smith) • Diameter of Sieve/Valve Trays (Lieberman) • Diameter of Ballast Trays • Diameter of Fractionators • General • Control Schemes • Optimization Techniques • Reboilers • Packed Columns*
1100 – 1230	***Absorbers*** *Hydrocarbon Absorbers Design • Hydrocarbon Absorbers*
1230 – 1245	*Break*
1245 – 1420	***Absorbers (cont'd)*** *Optimization • Inorganic type*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

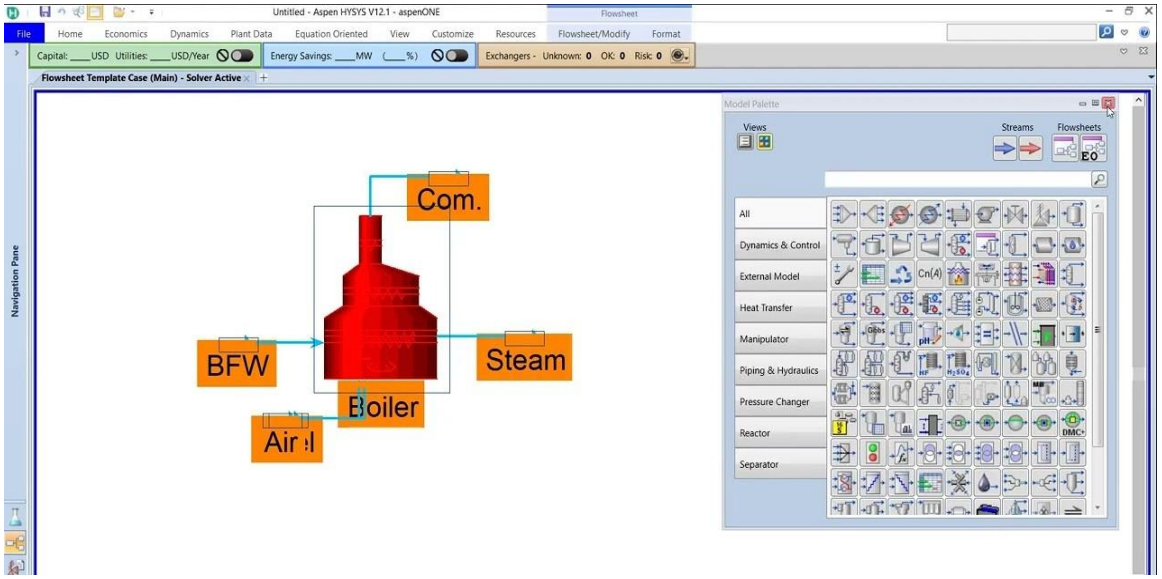
0730 – 0930	***Pumps*** *Affinity Laws • Horsepower • Efficiency • Minimum Flow • General Suction System*
0930 – 0945	*Break*
0945 – 1100	***Pumps (cont'd)*** *Suction System NPSH Available • Suction System NPSH For Studies • Suction System NPSH with Dissolved Gas • Larger Impeller • Construction Materials*
1100 – 1230	***Drivers*** *Motors: Efficiency • Motors: Starter Sizes • Motors: Service Factor • Motors: Useful Equations • Motors: Relative Costs • Motors: Overloading*
1230 – 1245	*Break*
1245 – 1420	***Drivers (cont'd)*** *Steam Turbines: Steam Rate • Steam Turbines: Efficiency • Gas Turbines: Fuel Rates • Gas Engines: Fuel Rates • Gas Expanders: Available Energy*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Separators/Accumulators*** *Liquid Residence Time • Vapor Residence Time • Vapor/Liquid Calculation Method • Estimating Equilibria • Liquid/Liquid Calculation Method*
0930 – 0945	*Break*
0945 – 1100	***Separators/Accumulators (cont'd)*** *Pressure Drop • Vessel Thickness • Gas Scrubbers • Reflux Drums • General Vessel Design Tips*
1100 – 1215	***Boilers*** *Power Plants • Controls • Thermal Efficiency • Stack Gas Enthalpy• Stack Gas Quantity • Steam Drum Stability • Deaerator Venting • Water Alkalinity • Blowdown Control • Impurities in Water • Conductivity Versus Dissolved Solids • Silica in Steam • Caustic Embrittlement • Waste Heat*
1215 – 1230	*Break*
1230 – 1300	***Cooling Towers*** *System Balances • Temperature Data • Performance • Performance Estimate: A Case History, Transfer Units*
1300 – 1345	***Q & A Discussion***
1345 – 1400	***Course Conclusion***
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 "ASPEN HYSYS" simulator.



ASPEN HYSYS V12.1 Simulator

Course Coordinator

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