COURSE OVERVIEW PE0663-4D
Process Equipment Design, Applications, Maintenance & Troubleshooting: *Rules of Thumb for Process Engineers*

Course Title
Process Equipment Design, Applications, Maintenance & Troubleshooting: *Rules of Thumb for Process Engineers*

Course Date/Venue
December 16-19, 2024/ Al Aziziya Hall, The Proud Hotel Al Khobar, Al Khobar, KSA

Course Reference
PE0663-4D

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

Plant and Equipment Design still forms an integral part of the Chemical's Engineer's theoretical training. However very few engineers will actually engage in detail design during their careers. Detail plant and equipment design has become a specialized discipline with companies offering services such as Front-End Engineering and Design (FEED) as a dedicated service (core business principle). This, however, does not take away the responsibility for correct and applicable design from the owner, and it is therefore essential for the plant Chemical Engineer to verify design details once it lands on his desk before approval for construction. Also, the Chemical Engineer will often be faced with plant and operational problems that need quick and reliable solutions as part of his normal day-to-day duties.

This **state-of-the-art** course is designed to provide comprehensive understanding of process equipment design concepts and techniques. Process design methods and criteria are presented and discussed to familiarize engineers with practical techniques for selection, sizing and design of process equipment for refineries, petrochemical and related oil and gas processing plants. During the course period, participants will be trained in the use of **rules-of-thumb** and **example problems** on the course topics.

The course will provide Chemical and Process Engineers with a lot of rules of thumb common sense techniques and calculation methods to quickly solve day-to-day design, operations and equipment problems. The practical tips, handy formulas, correlations, curves, charts, tables, and rules of thumb presented in this course will save engineers valuable time and effort.

In addition to basic calculation procedures for design and rating of process equipment, design approaches in revamp of existing plant facilities are also discussed and guidelines provided. Each session will be conducted in a lecture/discussion format designed to provide intensive instruction and guidance.

Course Objectives

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

- Apply rules-of-thumb for process equipment design, applications, maintenance and troubleshooting
- Define rule of thumb and analyze the nature of design as well as design constraints and design categories
- Calculate, evaluate and compile basic process data essential for design of process equipment and plant
- Perform evaluations of existing equipment designs and revamp methods
- Prepare comprehensive process design specification document package
- Explain the process of fluid flow, heat exchangers and implement the rules of thumb on fractionators and absorbers
- Discuss the characteristics of pumps and compressors
- Classify the different types of drivers, process vessels and reactors
- Differentiate types and properties of boilers, furnaces and direct-fired heaters
- Identify cooling towers including syste m balances, temperature data, performance and transfer units
- Implement proven methodology of process control as well as materials of construction
- Prepare scoping cost estimates and conduct evaluations of equipment and contractors' design proposals
- Maintain and troubleshoot process equipment and solve their related problems

- **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 process equipment design, applications, maintenance and troubleshooting for process engineers engaged in the design of new process equipment and revamp of existing plants and who also in-charge of troubleshooting and maintaining of such equipment. The course is also recommended for mechanical, equipment and project engineers who wish to learn basic principles of process design and process equipment and who are willing to troubleshoot and maintain such equipment.

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 Fee

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

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.

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. Mike Poulos, MSc, BSc, is a **Senior Process Engineer** with over **35 years** of industrial experience within the **Utilities**, **Refinery**, **Petrochemical** and **Oil & Gas** industries. His expertise lies extensively in the areas of **Process Equipment Design & Troubleshooting**, **Petroleum Processing**, **Process Design Specifications**, **Process Calculation Methods**, **Equipment Sizing & Selection**, **Piping**, **Pumps**, **Compressors**, **Heat Exchangers**, **Air Coolers**, **Direct-Fired Heaters**, **Process Vessels**, **Fractionator Columns**, **Reactors, Ancillary Equipment**, **Mechanical & Safety Aspects**, **Cost Estimation**, **Commissioning & Start-Up**, **Production & Cost Reduction**, Reactor Building Ventilation System, **PVC** Initiators Storage Bunkers, **PVC** Modernization & Expansion, **PVC** Reactor, **PVC** Plant Reactors Pre-Heating, **PVC** Plant Start-Up & Commissioning, **PVC** Plant Shutdown, **PVC** Driers Automation, **VC**M Recovery, **VCM** Sphere Flooding System, **VCM** Storage Tanks, Steam Tripping Facilities, Solvents Plant Automation Commissioning & Start-Up and Inferential Properties System. Further, he is also well-versed in Advanced Process Control Technology, Designing Process Plant Fail-Safe Systems, Quantitative Risk Assessment, On-Line Statistical Process Control, Principles and Techniques of Contemporary Management, Rosemount RS3, Polymer Additives, Polymer Reaction Engineering, Polymer Rheology and Processing, GRID Management and Batch Process Engineering.

During his career life, Mr. Poulos held significant positions as the **Chemical Plants Technology Engineer**, **PVC Plant Production Engineer**, **PVC Plant Shutdown Coordinator**, **PVC Plant/CC Solvents Plants Acting Section Head** and **Chemical Distribution Section Head** from Hellenic Petroleum, wherein he was responsible for the development of integrated system.

Mr. Poulos has **Master** and **Bachelor** degrees in **Chemical Engineering** from the **University of Massachusetts** and **Thessaloniki Polytechnic** respectively. Further, he is a **Certified Instructor/Trainer, a** and a **member** of the **Greek Society of Chemical Engineers** and **Greek Society of Engineers**.

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: ***Monday 16th of December 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Introduction*** *Rule of Thumb – Definition ● Nature of Design ● Design Constraints ● Design Categories*
0900 – 0930	***Petroleum Properties, Parameters & Definitions*** *Composition of Petroleum ● Petroleum Processing: An Overview ● Hydrocarbon Properties: (Pure Hydrocarbons, Defined Mixtures, Undefined Mixtures) ● Characterization Parameters & Definitions*
0930 – 0945	*Break*
0945 – 1130	***Development of Process Design Data & Calculation Methods*** *Process Design Tasks & Sequence ● Process Calculations Methods: (Empirical Procedure, Rigorous Procedure)*
1130 – 1230	***Fluid Flow*** *Energy Relationships ● Velocity Head ● Piping Pressure Drop ● Equivalent Length ● Recommended Velocities ● Two-phase Flow ● Sonic Velocity ● Metering ● Control Valves ● Safety Relief Valves*
1230 – 1245	*Break*
1245 – 1420	***Heat Exchangers*** *Types • Shell-and-Tube Construction – TEMA ● Heat Transfer Relation ● Key Design Considerations, Process Applications ● 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*** *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: ***Tuesday 17th of December 2024***

0730 – 0900	***Fractionators*** *Fractionator Types: Simple and Complex Columns ● Internals: Trays, Packing/Grids, etc ● Hydraulic Criteria ● Performance Comparison ● Reboilers ● Packed Columns• Relative Volatility ● Minimum Reflux ● Minimum Stages ● Actual Reflux and Actual Theoretical Stages ● Reflux to Feed Ratio ● Actual Trays ● Graphical Methods ● Tray Efficiency ● Maintenance & Troubleshooting*
0900 – 0915	*Break*
0915 – 1100	***Absorbers*** *Hydrocarbon Absorbers Design ● Hydrocarbon absorbers ● Optimization ● Inorganic type*
1100 – 1230	***Pumps*** *Key Design Parameters ● Pump Selection Guidelines ● Affinity Laws ●*

	Performance Characteristics ● Horsepower ● Efficiency ● Minimum Flow ● Suction System ● NPSH Available ● Construction Materials ● Maintenance & Troubleshooting
1230 – 1245	*Break*
1245 – 1420	***Compressors*** *Categories and Types ● Compression Process ● Characteristics & Terminologies ● Key Design Parameters ● Compressor Control Methods ● Calculation Method/Typical Format & Examples ● Selection Guidelines ● Maintenance & 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 Two*

Day 3: ***Wednesday 18th of December 2024***

0730 – 0830	***Drivers*** *Motors: Efficiency ● Motors: Useful Equations ● Motors: Relative Costs ● Motors: Overloading ● Steam Turbines: Steam Rate ● Steam Turbines: Efficiency ● Gas Turbines: Fuel Rates ● Gas Engines: Fuel Rates ● Gas Expanders: Available Energy*
0830 – 0900	***Process Vessels (Separators/Accumulators)*** *Liquid Residence Time ● Vapour Residence Time ● Vapour/Liquid Calculation Method ● Estimating Equilibria ● Liquid/Liquid Calculation Method ● Pressure Drop ● Vessel Thickness ● Gas Scrubbers ● Reflux Drums ● General Vessel Design Tips*
0900 – 0915	*Break*
0915 – 1100	***Reactors*** *Fixed-Bed Reactors Types ● Gas Phase Reactors (GPR) ● Design Considerations ● Sizing Methods – Pressure Drop Calculations ● Internals ● Maintenance & Troubleshooting*
1100 – 1230	***Boilers, Furnaces and Direct-Fired Heaters*** *Types – Size and Configuration ● Fuel Options ● Combustion Systems ● Design Considerations – Process & Combustion ● Boiler Feedwater control ●Control Systems ● Troubleshooting ● Thermal Efficiency ● Stack Gas Enthalpy ● Stack Gas Quantity ● Steam Drum Stability ● Deaerator Venting*

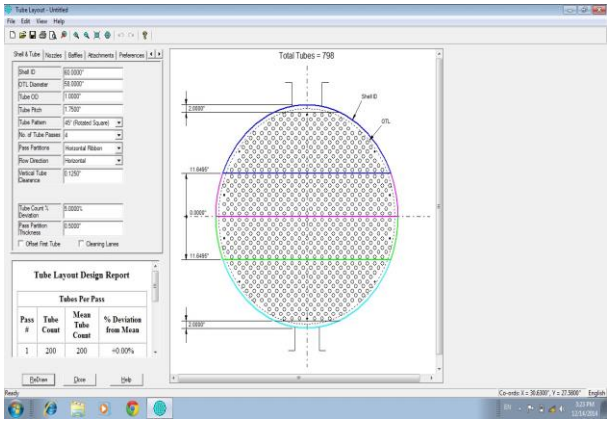
1230 – 1245	*Break*
1245 – 1330	***Cooling Towers*** *System Balances ● Temperature Data ● Performance ● Transfer Units*
1330 – 1420	***Process Control*** *PID Controllers ● Feedback, Feed Forward and Cascade Controls ● DCS ● Advanced Control*
1420 – 1430	***Recap*** *Using this Course Overview, the 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: **Thursday 19th of December 2024**

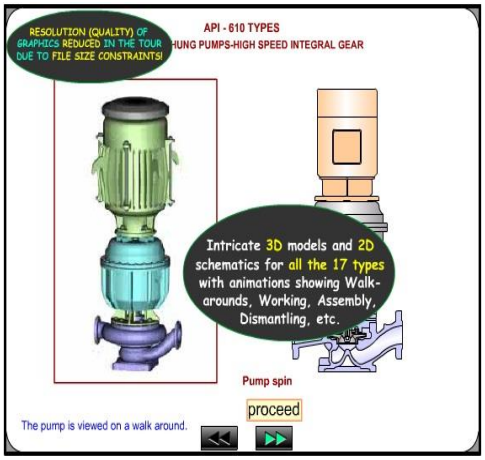
0730 – 0800	***Materials of Construction*** *Selection Criteria ● Construction Materials ● Code and Standards to Avoid Catastrophes ● Material Selection (Ferrous Material, Non Ferrous Material, Others) ● Corrosion Considerations*
0800 – 0900	***Process Risk Analysis*** *Risk Priority Matrix ● Evaluation Methods ● HAZOP Study ● QRA "Ishikawa" Diagrams ● MSD's*
0900 – 0915	*Break*
0915 – 1100	***Cost Estimating*** *Cost Estimating Methods ● Estimate Types and Accuracy ● Equipment Installation Factors ● Contingency Allowances ● Cost Escalation*
1100 – 1215	***Process Design Specifications*** *Purpose of Specification Package ● Types of Specification Packages ● Specification Package Contents ● Process Design in Project Cycle ● Cost of Process Design*
1215 – 1230	*Break*
1230 – 1345	***Q & A Discussion***
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*

Simulator (Hands-on Practical Sessions)

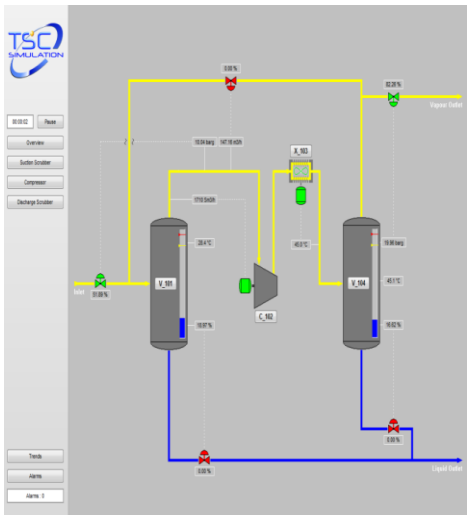
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulators “Heat Exchanger Tube Layout”, “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor”, “CBT on Compressors”, “Win Boiler Sim” and “ASPEN HYSYS”.



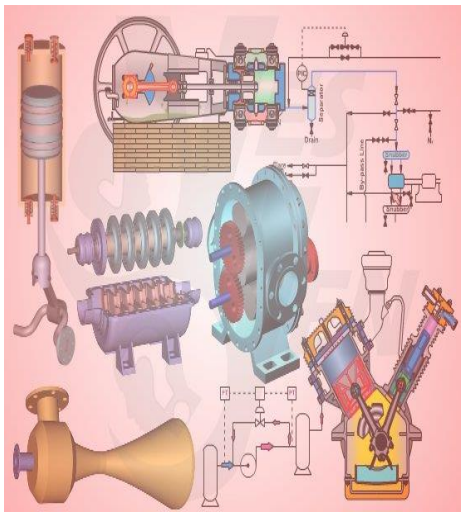
Heat Exchanger Tube Layout Simulator



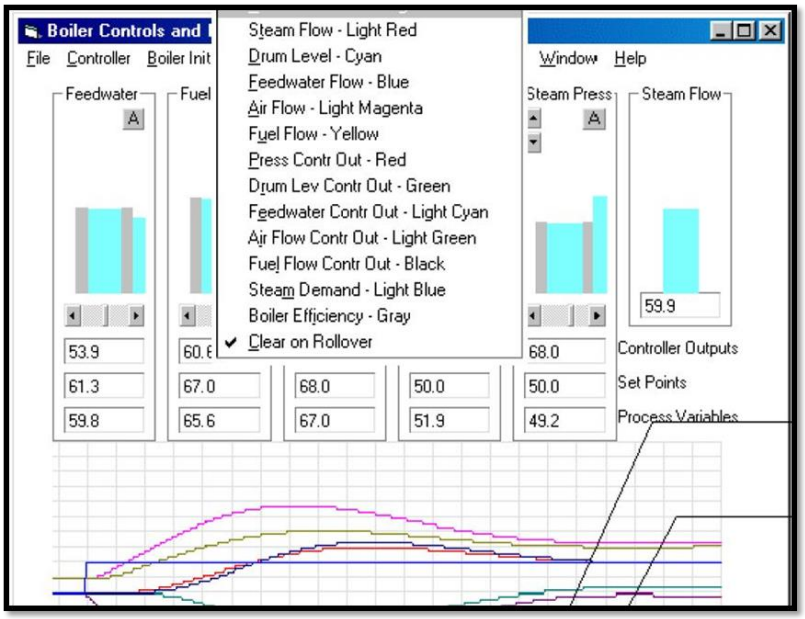
Centrifugal Pumps and Troubleshooting Guide 3.0



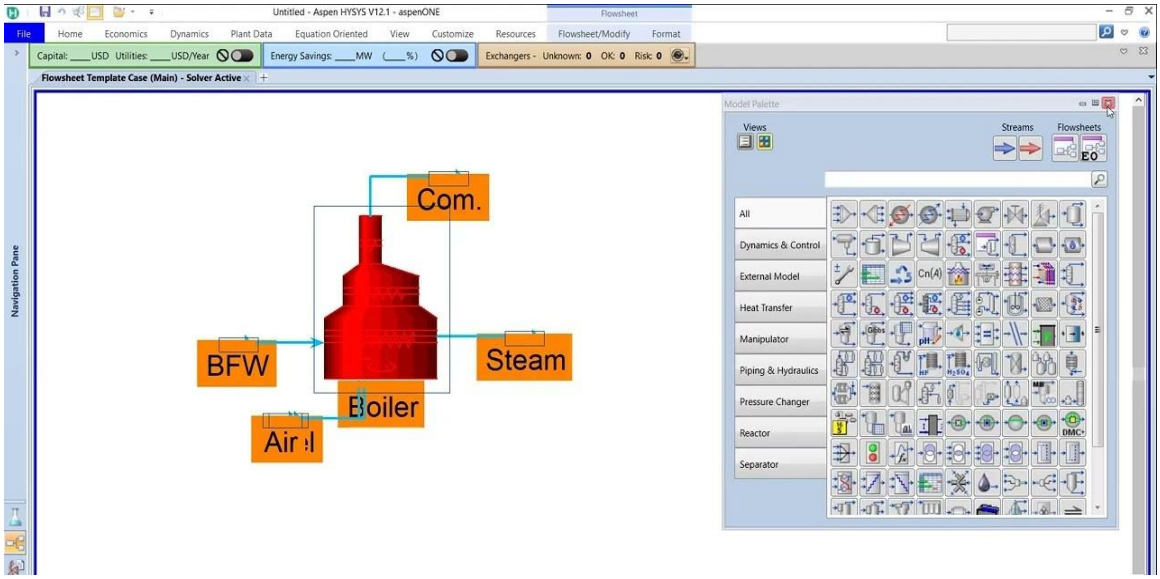
SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors



Win Boiler Sim



ASPEN HYSYS V12.1 Simulator

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