COURSE OVERVIEW PE0050
Elements of Applied Process Engineering

Course Title
Elements of Applied Process Engineering

Course Reference
PE0050

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

Course Date/Venue

Session(s)	Date	Venue
1	September 22-26, 2024	Horus Meeting Room, Holiday Inn & Suites Maadi, Cairo, Egypt
2	November 03-07, 2024	
3	January 26-30, 2025	

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 covers the application of chemical engineering theory to the practical demands of applied process engineering. The course will be presented in interactive format with many industrial examples and case studies. Participants will have the opportunity to solve sample problems with the help of the instructor.

The first part of the course will cover the basics of unit operations and the development of an effective process. Topics included are the preparation of process flow diagrams (PFDs) and P&IDs. These diagrams represent the organization and control of equipment in a petrochemical plant or refinery.

This is followed by the calculation of material flows and the concept of a material balance. Included are techniques on the sizing and evaluation of piping networks (including pipe segments, fittings, parallel piping systems, valves and controls equipment).

Pressure drop calculations are presented for a variety of systems – ordinary Newtonian liquids, vapors and mixed phase systems, reacting systems, packed beds and fluidized beds.

Next, the design and evaluation of major fluid flow equipment is presented. This includes pumps (all types) and compressors as well as fans, vacuum pumps, ejectors and educators. The associated drivers for these machines are discussed, especially steam turbines and the steam-power cycle found in all petrochemical plants and refineries
The materials portion of the course is followed by a presentation on energy balances and heat transfer equipment. Refrigeration energy balance, compressor selection, and power requirements are covered. Focus is on the cycles typically found in refineries and petrochemical plants, including cascaded and open systems.

In the next section of the class, materials of construction (MOC) are discussed and selection guidelines presented. Finally, heat transfer equipment selection, design and rating are discussed.

On completion of this course, participants will have the ability to understand and prepare PFDs and P&IDs, perform material/heat balance and fluid flow calculations. Participants will also be able to design, rate and select the major process equipment which accounts for most of the capital investment in refineries and petrochemical plants.

During the class, participants will be given detailed procedures and worksheets for performing the appropriate calculations. Many of the examples have been developed on EXCEL; these programs will be given to the participants on a CD. The tools provided should aid in the design and operation of chemical systems. This is an interactive course with numerous case studies and a CD with solved problems, worksheet and shortcut techniques.

Course Objectives

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

- Apply and gain an in-depth knowledge on process engineering and discuss the chemical & physical aspects as well as the processes and process variables used in applied process engineering
- Prepare PFDs and P&IDs in a professional manner
- Perform material/heat balance and fluid flow calculations
- Acquire knowledge with the various process development including process sketch, diagrams and unit operations
- Employ the application of fluid dynamics specifically its piping system design and flow systems and determine the different flow equipment used in process engineering
- Enumerate heat transfer components by explaining the elements of energy balances, heat exchangers, air coolers and fired heaters
- Develop an understanding on mass transfer attributes including distillation, tray performance & constraints, humification and refrigeration
- Identify the different types of chemical reactors and describe petroleum processing reactions including hydro treating, catalytic reforming & hydro cracking
- Discuss the process control applied in process engineering and identify the various construction materials as well as the method of selecting the materials to be used
- Carryout process risk analysis particularly the various evaluation methods and HAZOP study

Who Should Attend

This course provides an overview of the major elements of applied process engineering for process and project engineers as well as piping designers. The course will also be valuable as a refresher for experienced chemical engineers and those who are not familiar with some aspects of applied process engineering. Additionally, managers and supervisors who have no formal training in chemical engineering should find value in this course.

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$ 5,500 per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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 **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.

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. Henry Beer is a **Senior Process Engineer** with over **35 years** of indepth industrial experience within the **Petrochemical**, **Oil & Gas** industries specializing in **Hydrocarbon Process** Equipment, **DOX Unit** Operation & Troubleshooting, **Polyethylene & Polypropylene** Processing, **Oil Movement** Storage & Troubleshooting, **Power Plant Chemistry**, **Fuel Quality** Monitoring System Fundamentals, **Liquid Bulk Cargo Handling**, **Oil Refinery Cost Management**, **Flare & Blowdown** Operation, **Pressure Relief Systems** Maintenance & Troubleshooting, Refinery **SRU**, **Tail Gas** Treating, **Sour Water & Amine Recovery** Units, **Propylene** Compressor and Turbine, **Clean Fuel** Technology & Standards, Principles of **Operations Planning**, **Heat Exchangers & Fired Heaters** Operation & Troubleshooting, **Plastic Extrusion Technology** Operation & Troubleshooting, **Chemical Engineering** for Non-Chemical Engineers, **Process Plant** Troubleshooting, **Process Plant Optimization** Technology, **Engineering Problem Solving**, **Process Plant** Performance & Efficiency, **Process Plant** Start-up & Shutdown, **Process Plant** Commissioning, **Process Plant** Turn-around & Shutdown, **Pumps & Compressors** Troubleshooting, **Fired Heaters & Air Coolers** Maintenance, **Pressure Vessels & Valves** Repair, **Polymers**, **Plastics**, **Polyolefin** & **Catalysts**, **Polymerization**, **Thermal Analysis Techniques**, **Rheology**, **Thermoplastics**, **Thermosets**, **Coating Systems** and **Fibre Reinforced Polymer Matrix Composites**. Further, he is also well-versed in **Water Hydraulic Modelling**, **Efficient** Shutdowns, Turnaround & Outages, **Pump** Selection and Installation, Operation and Maintenance of **Pumps**, **Demand & Supply** Management, **Catalyst Manufacturing Techniques**, **Fuel Systems Management**, **Aviation Fuel**, **Diesel**, **Jet Fuel**, **Petrol** and **IP Octane**, **Cetane Control** and related Logistics, Road, Rail and Pipeline Distribution, **Process Design** and **Optimisation**, **Boiler Feed Water Preparation**, **Flocculation Sedimentation**, **Hot Lime Water Softening Processes**, **Desalination Processes**, **Reverse Osmosis**, **Molecular Sieves**, activated **Sludge Aerobic/Anaerobic**, **Sludge Removal** and **Incineration Process Control**, **Domestic Sewage Plants Optimisation**, **Process Cooling Water System**, **High Pressure** and **Low Pressure Tank Farm Management**, **Hydrocarbon** and **Chemical products** and **GTL** (**Gas to Liquids**).

During his career life, Mr. Beer holds significant key positions such as the **Director**, **Global Commissioning Manager**, **Process Engineering Manager**, **Senior Business Analyst**, **Process Engineer**, **Chemical Engineer**, **Senior Technician**, **Technical Sales Engineer**, **Entrepreneur**, **Financial Consultant**, **Business Analyst**, **Business Financial Planner** and **Independent Financial Planner** to various international companies such as the **Sasol**, **SASOLChem**, **TAG Solvents**, **Virgin Solvent Products**, **SARS** & **SAPIA** (**South African Petroleum Industry Association**) and **RFS Financial Services** (**Pty**) **Ltd**.

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	***Process Engineering*** *Process Engineering Overview*
0900 – 0930	***Chemical & Physical Principles*** *Dimensions & Units ● Processes & Process Variables ● Process Data Representation & Analysis*
0930 – 0945	*Break*
0945 – 1100	***Chemical & Physical Principles (cont'd)*** *Basic Chemical Calculations ● Stoichiometry ● Properties of Matter*
1100 – 1230	***Process Development*** *Process Sketch ● Block Diagram ● Process Flow Diagrams (PFDs) ● Piping & Instrumentation Diagrams (P & IDs) ● Other Diagrams ● Unit Operations*
1230 – 1245	*Break*
1245 – 1400	***Fluid Dynamics*** *Static Fluids ● Fluid Flow*
1400 – 1420	***Revision & Quiz***
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor (s) will Brief Participants about the Topics that were Discussed Today & Advice Them of the Topics to be discussed tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Fluid Dynamics (cont'd)*** *Piping Systems Design ● Complex Flow Systems ● Miscellaneous Flow Systems*
0930 – 0945	*Break*
0945 – 1100	***Flow Equipment*** *Fluid Flow Equipment Drivers & Power Cycles ● Compressible Flow Piping – Safety & Control*
1100 – 1230	***Flow Equipment (cont'd)*** *Pumps, Basic Concepts, Cavitation ● Compressors ● Fans ● Agitation & Mixing ● Filtration*
1230 – 1245	*Break*
1245 – 1400	***Heat Transfer*** *Energy Balances ● Heat Exchangers Overview*
1400 – 1420	***Revision & Quiz***
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor (s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be discussed tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Heat Transfer (cont'd)*** *Heat Exchangers Design ● Shell & Tube Heat Exchangers (TEMA Type)*
0930 – 0945	*Break*
0945 – 1100	***Heat Transfer (cont'd)*** *Air Coolers ● Fired Heaters*
1100 – 1230	***Mass Transfer*** *Physical Behavior Pure Components*
1230 – 1245	*Break*
1245 – 1400	***Mass Transfer (cont'd)*** *Distillation*
1400 – 1420	***Revision & Quiz***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

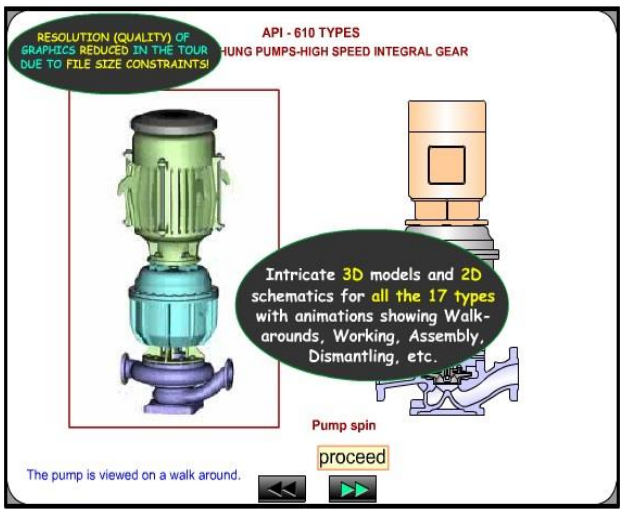
0730 – 0930	***Mass Transfer (cont'd)*** *Calculation Methods ● Trays Performance & Constrains, Tray Efficiency*
0930 – 0945	*Break*
0945 – 1100	***Mass Transfer (cont'd)*** *Crude Unit Optimization ● Packing, Trays versus Packing Comparison ● Humification & Refrigeration*
1100 – 1230	***Chemical Reactors*** *Petroleum Processing Reactions*
1230 – 1245	*Break*
1245 – 1400	***Chemical Reactors (cont'd)*** *Kinetics ● Reactor Types*
1400 – 1420	***Revision & Quiz***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

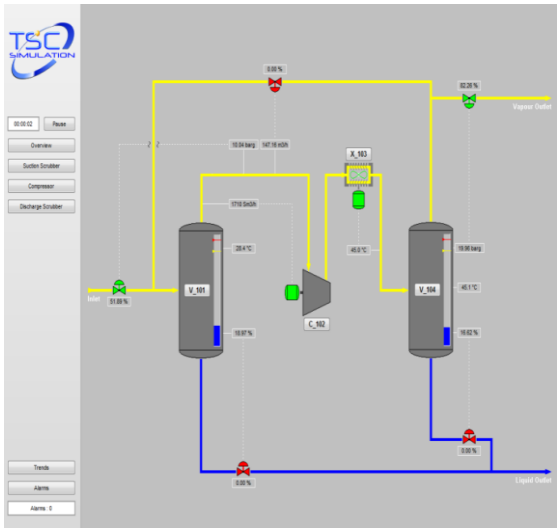
0730 – 0930	***Process Control*** *PID Controllers ● Feedback, Feed Forward & Cascade Controls ● DCS Advanced Control*
0945 – 1100	***Materials of Construction*** *Selection Criteria ● Construction Materials ● Code & Standards to Avoid Catastrophes*
1100 – 1230	***Materials of Construction (cont'd)*** *Material Selection (Ferrous Material, Non Ferrous Material, others) ● Corrosion Considerations*
1230 – 1245	*Break*
1245 – 1300	***Process Risk Analysis*** *Risk Priority Matrix ● Evaluation Methods ● HAZOP Study*
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)

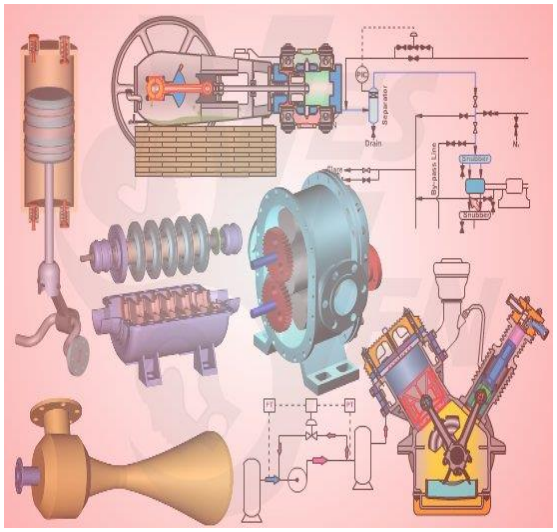
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using "Centrifugal Pumps and Troubleshooting Guide 3.0", "SIM 3300 Centrifugal Compressor", "CBT on Compressors", "Steam Turbines & Governing System CBT", "Heat Exchanger Tube Layout", "Gas Ultrasonic Meter (USM) Sizing Tool", "Liquid Turbine Meter and Control Valve Sizing Tool", "Liquid Ultrasonic Meter Sizing Tool" and "Orifice Flow Calculator" simulator.



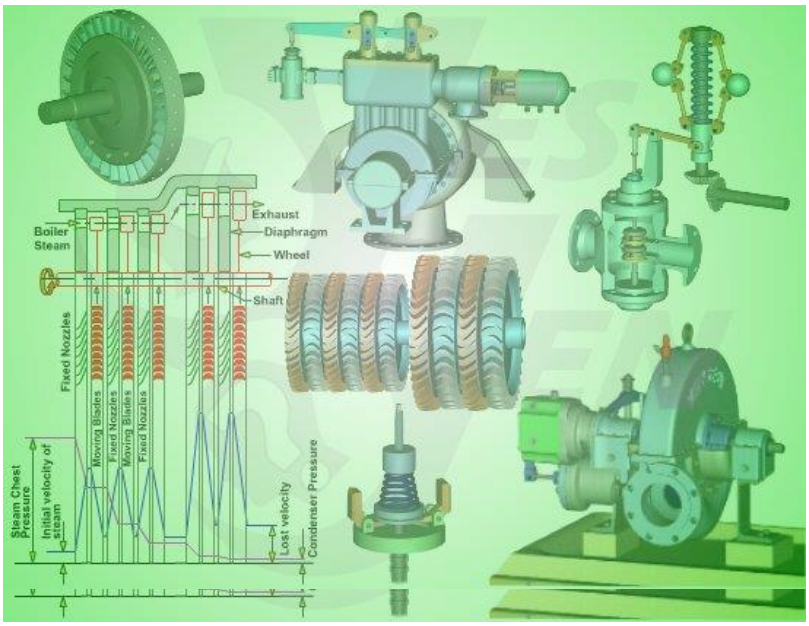
Centrifugal Pumps and Troubleshooting Guide 3.0



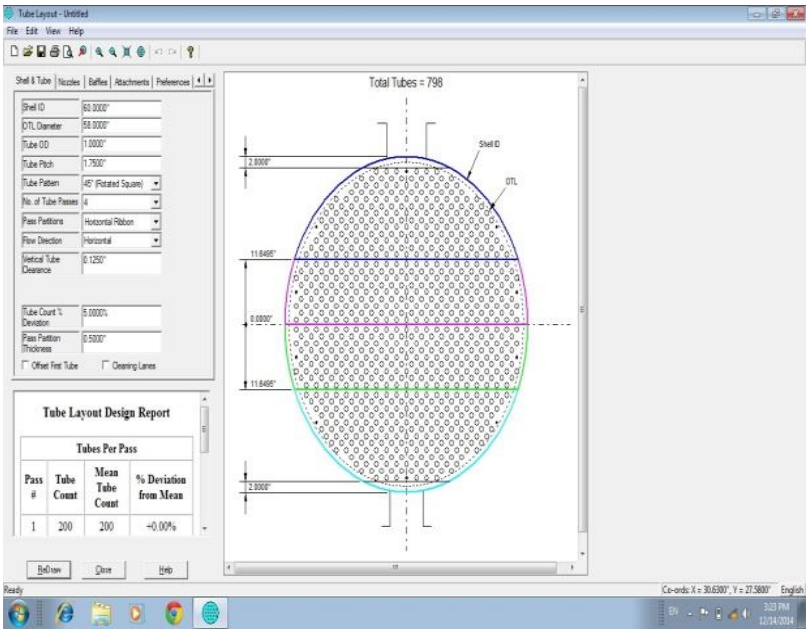
SIM 3300 Centrifugal Compressor Simulator



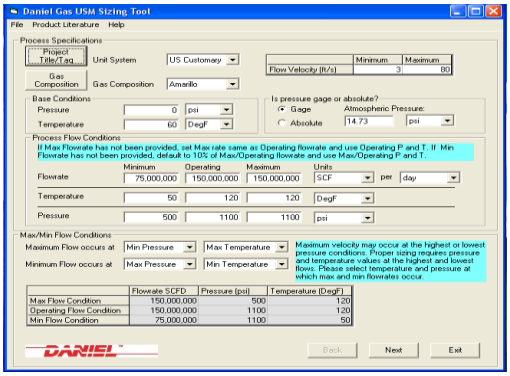
CBT on Compressors



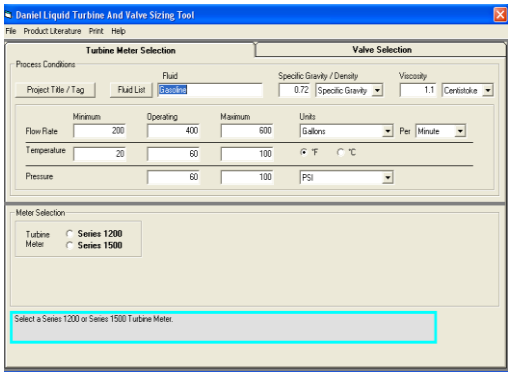
Steam Turbines & Governing System CBT



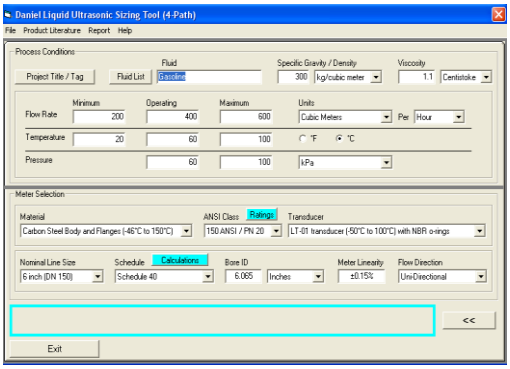
Heat Exchanger Tube Layout



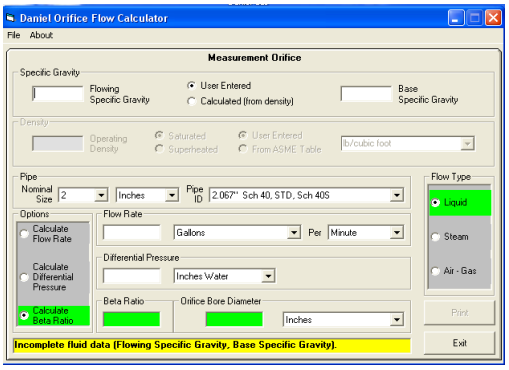
Gas Ultrasonic Meter (USM) Sizing Tool Software



Liquid Turbine Meter and Control Valve Sizing Tool Software



Liquid Ultrasonic Meter Sizing Tool Software



Orifice Flow Calculator Software

Course Coordinator

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