



COURSE OVERVIEW ME0160-4D

Modern Heating, Ventilation, Air-Conditioning (HVAC) & Refrigeration Systems: Design, Installation, Maintenance & Troubleshooting

Course Title

Modern Heating, Ventilation, Air-Conditioning (HVAC) & Refrigeration Systems: *Design, Installation, Maintenance & Troubleshooting*

Course Date/Venue

October 07-10, 2024/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference

ME0160-4D

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 in the class will be applied using the following practical methods:

(1) Industrial Facility Visit: Course participants will be taken to an industrial facility where they will practice testing, maintenance and troubleshooting. In case that this course is organized inside client premises (In-House), then client shall provide access to its HVAC and refrigeration workshop for practical sessions.



(2) HVAC Simulator: Participants will use in the class the state-of-the-art HVAC Simulator to practice some of the skills learnt.



The course is designed for engineers and other technical staff from a wide range of abilities and backgrounds. It will provide the participants with a complete and up-to-date overview of the area of heating, ventilation, air-conditioning (HVAC) and refrigeration. It commences with a review of psychrometric charts and then examines the factors that influence design choices, indoor air quality, load calculations and heating/ventilation and airconditioning systems. Numerous tips and tricks throughout the course make it very practical and topical to your applications.





Course Objectives

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

- Design, install, maintain and troubleshoot HVAC and refrigeration systems
- Recognize and apply the psychrometric chart
- Design for good air quality
- Perform basic load calculations
- Initiate an effective inspection and maintenance program
- Minimize forced outages and prevent serious damage to HVAC equipment
- Provide an overview of the legislative requirements plus the essential steps and responsibilities for the maintenance and repair of HVAC Systems
- Employ technologies available for the efficient energy management using HVAC 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, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides a complete and up-to-date overview of HVAC & refrigeration systems for HVAC, utilities, maintenance, plant, operation and inspection engineers and other technical staff who are involved in the design, installation, maintenance and troubleshooting of such equipment and system. Further, it is suitable for mechanical, design, electrical and consulting engineers.

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 completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations:-

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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.

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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. Mustafa Fadel is a **Senior Mechanical Engineer** with over **25 years** of industrial experience within the **Power & Water Utilities** and other **Energy Sectors**. His specialization widely covers **District Cooling: Plant: Design, Operation & Maintenance HVAC System**, HVAC Equipment Terminology, **HVAC System Block Load Calculation**, HVAC System Development of Drawings, **Air Distribution System**, Basic **Chiller Water System Design & Selection**, **Pump Design & Selection**, **Rotating & Static Equipment**, **Cooling Tower Design**, **Boiler Design & Selection**, Energy Management & Value Engineering for Mechanical System, Mechanical Ventilation, Smoke Ventilation, Staircase Pressurization, System Design & Development of Drawings, Data Center Design, **Precision AC Equipment Selection**, **Refrigeration Systems**, **Air Cooler Design**, **Chillers**, **Mass & Heat Transfer**, **Electromechanical**, **Rotating & Static Equipment** including **Heat Exchangers**, **Piping & Pipeline**, **Pressure Vessels**, **Valves**, **Tanks Turbines**, **Compressors**, **Motors**, **Pumps**, **Evaporators**, **Condensers**, **Blowers and Fans**, **Maintenance Planning & Scheduling**, **Root Cause Failure Analysis**, **Performance Calculations**, **Reliability Maintenance** and **Corrective & Preventive Maintenance**. Further, he is also well-versed in **HSE Management**, **KPI's**, **CMMS** and **AutoCAD** as well as in various international standards such as the **ASHRAE**, **API**, **ASTM**, **ASME**, **AMCA**, **NFPA** and **SMACNA**. Currently, he is the **HVAC&R Specialist** in **SEGAS LNG Plant** wherein he is responsible for the implementation, construction and maintenance strategy for industrial HVAC&R equipment.

During his career life, Mr. Fadel has gained his practical and field experience through his various significant positions and dedication as the **Section Head**, **Project Manager**, **HVAC System Consultant Engineer**, **Mechanical Engineer**, **HVAC&R Instructor** and **Senior Technical Consultant** for international companies and universities like the **Foster Wheeler**, **Technip-Italy**, **Borner Company**, **Union FENOSA Gas**, **Asphalt Bitumen**, **King Khalid University**, **Alexandria Petroleum Company**, **FAWAZ Company**, **Marium Corporation** and many more.

Mr. Fadel has a **Bachelor** degree in **Power Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and an active member of the American Society of Heating Refrigerating and Air Conditioning Engineers (**ASHRAE**), **USA**. He has further delivered and participated numerous engineering and inspection projects, trainings, courses, seminars and conferences globally.



Course Program

The following program is planned for this course. However, the course instructors) 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, 07th of October 2024

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0915	Introduction Introduction to HVAC Basics • HVAC&R Abbreviations • HVAC Codes and Standards • HVAC&R Definitions • Air Conditioning • Ventilation • Refrigeration • HVAC&R Overview
0915 – 0930	Break
0930 – 1030	Basic Principals of HVAC&R Air Properties • Dry Bulb Temperature • Wet Bulb Temperature • Dew Point • Humidity Ratio • Relative Humidity • Psychrometric Chart Definition • Properties of Psychrometry • Psychrometric Chart • Psychrometric Chart Application
1030 – 1115	Principles of Heat Transfer Heat Transfer • Method of Heat Transfer • Sensible and Latent Heat • Sensible Heat Definition • Latent Heat Definition • First Law of Thermodynamic
1115 – 1215	Design Conditions Outdoor Climate • Indoor Comfort • Solar Orientation • Indoor Air Quality
1215 – 1230	Break
1230 – 1330	Air Purification Methods and Air Motion Comfortable Velocity Ranges • Heat Gain From Occupants
1330 – 1420	Moisture Removal, Design Conditions
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, 08th of October 2024

0730 – 0815	HVAC Design Criteria Load Calculations • Load Components • Sensible Load • Latent Load • Load Categories • Skin Load • Internal Loads • People Load • Light Load • Equipment Load
0815 – 0900	Room Load Effective Load • Other Loads (Return Air Side Load –Supply Air Side Load) • Other Loads (Ventilation Load) • Grand Load • Refrigeration Load • Summer Air Conditioning System with Return Air (for Example)
0900 – 0945	Air Conditioning (Equipment- Systems) Case Study: Manual Calculations • Design Calculations for Super Market in Egypt – Alexandria City • Load Calculations System • Manual Calculations • Room Load Calculations • Transmission Load • Sun Load Calculation • Persons Load • Light Load • Equipment Load
0945 – 1000	Break





1000 – 1100	Total Room Load Plot Design Conditions on Psychrometric Chart • Sensible Heat Factor • Ventilation (Outside Air Load) Sensible Load Calculation • Ventilation Latent Load Calculation • Coil Load Calculation • Mixing Point • Supply Point • Apparatus Dew Point
1100 – 1200	Duct Design Duct Design Methods • Equal Friction Method • Using Ductlator • Duct Sizer Software • Duct Design Procedures • Duct Types • Diffusers –Grills • Duct Accessories – Case Study • Cooling System Selection
1200 – 1215	Break
1215 – 1330	Duct Insulation Material Selection & Sizing
1330 – 1420	Hourly Analysis Program (HAP) System Data Input • Output Report
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, 09th of October 2024

0730 – 0815	Practical Calculations Case Study • Gymnasium in USA Data Input
0815 – 0900	Refrigeration Definition • Systems • Types • Components • P-H Chart • Calculations • Superheat Degrees • Sub-Cooling Degrees • Refrigerants • COP Calculations • EER Calculations • Water System Calculations • Case Study • Ton of Refrigeration
0900 – 0945	Chillers Chiller Components • Types of Compressors • Reciprocating Compressor • Screw Compressor • Scroll Compressor • Centrifugal Compressor • Air Cooled Condensers • Water Cooled Condensers • Evaporative Condensers
0945 – 1000	Break
1000 – 1100	Comparison Between Air Cooled and Water Cooled Condensers
1100 – 1215	Flooded Evaporators – DX Evaporators
1215 – 1230	Break
1230 – 1330	Absorption Refrigeration Cycle Expansion Devices • Pressure Gages • Test Manifolds • Recovery Units
1330 – 1420	Testing – Maintenance Purging • Pump Down • Leak Test • Adding Oil • Commissioning
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, 10th of October 2024

0730 – 0815	Maintenance Definition • Objectives • Goals • Equipment Life Cycle • Types of Maintenance • Chiller Maintenance
0815 – 0900	Fault Finding Objectives • Introduction • Faults
0900 – 0945	Troubleshooting Skills Troubleshooting Tools • Technical Equipment
0945 – 1000	Break
1000 – 1100	Troubleshooting Procedures Equipment Failure
1100 – 1215	Troubleshooting Analysis
1215 – 1230	Break
1230 – 1345	Maintenance Case Studies
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



Practical Sessions/Site Visit





Simulator (Hands-on Practical Sessions)

The image shows four windows from the HVAC simulation software:

- Weather Properties - [Chicago IAP]**: Shows location (U.S.A., Illinois, Chicago IAP), latitude (42.0 deg), longitude (87.9 deg), and elevation (673.0 ft). It also includes atmospheric cleanliness, ground reflectance, and time zone settings.
- Space Properties - [D107 - Classroom]**: Configures overhead lighting (recessed, unvented, 3.00 W/ft²), task lighting, and electrical equipment (0.00 W/ft²).
- Schedule Properties - [Lighting - Classrooms]**: Displays a profile for 'School_In_Session' with a bar chart showing 100% activity during school hours.
- Air System Properties - [Packaged Rooftop AHU]**: Sets ventilation air data, including demand controlled ventilation, ASHRAE Std 62.1-2004 sizing method, and various fan and damper settings.

Hourly Analysis Program (HAP) Software

The image shows the Elite HVAC Simulator software interface. The main window is a drawing board titled 'Sample DB Chvac 7.CHV - Chvac - [Drawing Board]'. It displays a room layout with a yellow hatched area representing the room. A properties window is open for 'Ground Reflectance for Roof', showing a list of materials and their reflectance values:

Reflectance	Description
32	New concrete
23	Old concrete
25	Bright green grass
20	Crushed rock [Default]
14	Bitumen and gravel roof
10	Bituminous parking lot

Elite HVAC Simulator





Danfoss Refrigerant Slider App	Danfoss Trouble Shooter App	Air Lite Psychrometric Calcs

Course Coordinator

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