



MU033:

Modern Heating, Ventilation, Air-Conditioning (HVAC) & Refrigeration Systems:

Design, Installation, Maintenance & Troubleshooting

Training Description:

This intensive training 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.

This **hands-on, highly-interactive training course includes various practical sessions and exercises**. Theory learnt in the class will be applied using the following practical methods:

- (1) **Industrial Facility Visit:** training 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.

Training Objectives:

By the end of the training, participants 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

Training Designed for:

This course is intended 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 Requirement:

"Hand's on practical sessions, equipment and software will be applied during the course" if required and as per the client's request."

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client's learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Program:

DAY ONE:

- ❖ PRE-TEST
- ❖ Introduction
 - Introduction to HVAC Basics
 - HVAC&R Abbreviations
 - HVAC Codes and Standards
 - HVAC&R Definitions
 - Air Conditioning
 - Ventilation
 - Refrigeration
 - HVAC&R Overview
- ❖ 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
- ❖ Principles of Heat Transfer
 - Heat Transfer
 - Method of Heat Transfer
 - Sensible and Latent Heat
 - Sensible Heat Definition
 - Latent Heat Definition
 - First Law of Thermodynamic
- ❖ Design Conditions
 - Outdoor Climate
 - Indoor Comfort
 - Solar Orientation
 - Indoor Air Quality
- ❖ Air Purification Methods and Air Motion
 - Comfortable Velocity Ranges
 - Heat Gain from Occupants
- ❖ Moisture Removal, Design Conditions
- ❖ Recap

DAY TWO:

- ❖ HVAC Design Criteria
 - Load Calculations



- Load Components
- Sensible Load
- Latent Load
- Load Categories
- Skin Load
- Internal Loads
- People Load
- Light Load
- Equipment Load
- ❖ **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)
- ❖ **Air Conditioning (Equipment- Systems)**
 - Case Study: Manual Calculations
 - Design Calculations for Super Market in Egypt – Cairo City
 - Load Calculations System
 - Manual Calculations
 - Room Load Calculations
 - Transmission Load
 - Sun Load Calculation
 - Persons Load
 - Light Load
 - Equipment Load
- ❖ **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
- ❖ **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
- ❖ **Duct Insulation Material Selection & Sizing**
- ❖ **KOTZA**
 - System Data Input
 - Output Report
- ❖ **Recap**

DAY THREE:

- ❖ **Practical Calculations**
 - Case Study
 - Gymnasium in USA Data Input
- ❖ **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
- ❖ **Chillers**
 - Chiller Components
 - Types of Compressors
 - Reciprocating Compressor
 - Screw Compressor
 - Scroll Compressor
 - Centrifugal Compressor
 - Air Cooled Condensers
 - Water Cooled Condensers
 - Evaporative Condensers
- ❖ **Comparison Between Air Cooled and Water-Cooled Condensers**
- ❖ **Flooded Evaporators – DX Evaporators**
- ❖ **Recap**

DAY FOUR:

- ❖ **Absorption Refrigeration Cycle**
 - Expansion Devices
 - Pressure Gages



- Test Manifolds
- Recovery Units
- ❖ **Testing – Maintenance**
 - Purging
 - Pump Down
 - Leak Test
 - Adding Oil
 - Commissioning
- ❖ **Maintenance**
 - Definition
 - Objectives
 - Goals
 - Equipment Life Cycle
 - Types of Maintenance
 - Chiller Maintenance
- ❖ **Fault Finding**
 - Objectives
 - Introduction
 - Faults
- ❖ Recap

DAY FIVE:

- ❖ Site Visit
- ❖ **Troubleshooting Skills**
 - Troubleshooting Tools
 - Technical Equipment
- ❖ Troubleshooting Procedures
 - Equipment Failure
- ❖ **Troubleshooting Analysis**
- ❖ **Maintenance Case Studies**
- ❖ Course Conclusion
- ❖ POST-ASSESSMENT and EVALUATION

Training Certificate(s):

CMCT Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Fees:

TBA as per the course location - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

For training registrations or in-house enquiries, please contact:

Aisha Relativo - Training & Career Development Manager

aisha@cmc-me.com / training@cmc-me.com

Tel.: +971 2 665 3945 or +971 2 643 6653 | Mob.: +971 52 2954615