



## Module Outline

### Welcome to the AIRAH 'Cooling Towers in HVAC&R Part 1 – Selection and design' course

The purpose of this course is to provide participants with the information required to assist in understanding the appropriate selection and design requirements when applying cooling towers as the heat rejection method in an HVAC&R system.

Some prior knowledge and/or experience in HVAC&R systems and their components will help ensure participants gain optimum benefit from the course.

### How to Work Through this Course:

You can navigate through the course content by using the navigational arrows in the course content or the table of contents in the side bar. You can return to the main menu at any time by using the link provided in the table of contents

### Activities / Assessment overview etc

For every one of the Topics in this course, there is a self-assessment section. You need to complete this assessment (which may entail reading articles, visiting websites or referring to one of the reference texts), to demonstrate your knowledge and competency. There are multiple self-assessments methods used including:

- Multiple choice questions
- Drop and Drag to diagram
- Labelling diagrams and other images
- Performing calculations
- Matching statements with answers

# Introduction

This module covers the following topics.

## Topic 1: What is a cooling tower

- Evaporative cooling fundamentals
- Psychrometrics of the cooling tower
- Cooling towers and public health
- Standards and regulations
- Evaporative cooling versus dry heat exchange

## Topic 2: Types of cooling towers

- Classification of cooling towers
- Direct contact evaporative cooling towers
- Indirect contact evaporative cooling towers
- Tower classification by
  - Draft development method
  - Position of fan
  - Direction of fluid flow
- Other classes/types of cooling towers

## Topic 3: Cooling towers in HVAC&R

- Forced draft tower
- Induced draft cooling tower
- Counterflow and crossflow induced draft cooling tower
- Closed circuit indirect cooling tower
- Evaporative condenser

## Topic 4: Components and materials

- Components
- Tower accessories
- System pumps
- Pipework and fittings
- Water filtration and cleaning
- Cooling tower materials

## Topic 5: Selecting a cooling tower

- Fundamental selection criteria
- Tower performance
- Tower water consumption
- Evaporation and bleed rate
- Energy considerations
- Life cycle costing

- Tower selection – decision matrix
- Optimising a design

## **Topic 6: Designing a system**

- Design and risk management
- Cooling tower – design standards
- Designer responsibility
- Safety in design
- Maintenance in design
- Access requirements
- System design
- Tower design
- Water treatment
- Air side and Water side design considerations
- Selecting a tower location

# Learning Outcomes

At the completion of this course participants will be able to:

- Understand the fundamentals of evaporative cooling
- Describe the evolution of cooling towers
- Outline the potential impacts on public health
- Identify the primary standards and regulations
- Explain the advantages of a cooling tower over dry heat exchangers
- Outline the alternatives to evaporative cooling towers
- Understand the three methods of heat exchange available for heat rejection/cooling
- Outline how cooling towers are classified
- Describe how direct contact evaporative cooling towers operate
- Describe how indirect contact evaporative cooling towers operate
- Explain the hybrid cooling tower variations
- Identify the variations between cooling tower classifications
- identify the types of air flow relative to cooling towers
- Identify the main types of cooling towers found in HVAC&R systems and
- Understand the primary configuration and operation of the:
  - Forced draft cooling tower
  - Induced draft cooling tower
  - Counterflow induced draft cooling tower
  - Crossflow induced draft cooling tower
  - Closed circuit indirect cooling tower
  - Evaporative condenser
- Describe the main components of a cooling tower
- Define the function of each of the components of a cooling tower
- Identify the main cooling tower accessories
- Define the purpose of water filtration
- Describe the main type of water filters and water filtration systems
- Outline the types of materials used for cooling tower construction and components
- Identify the fundamental criteria to identify when selecting cooling towers
- Describe the primary parameters of cooling tower performance
- Calculate the rate of heat rejection
- Rate and size a cooling tower
- Define the different elements that make up the tower water consumption
- Quantify evaporation, bleed, make up and cycles of concentration
- Identify the main energy considerations for effective tower application
- Evaluate the life cycle costs of a cooling tower selection
- List all of the decisions in the tower selection process
- identify the elements for optimal selection of a cooling tower
- Provide a supplier relevant information of a cooling system to permit accurate selection
- List the issues to be considered when designing for microbial control,
- Explain the purpose of life cycle costing design alternatives

- Identify the main design standards for cooling water systems
- Outline the design responsibilities for safe design, including accommodating maintenance
- Explain access requirements and standards
- Outline the main components of tower and system design
- Explain the purpose and application of water treatment in cooling water systems
- Outline the main air-side design considerations
- Outline the main water-side design considerations
- Identify the considerations to take into account when selecting a tower location