1. Module details

Module name

AIR CONDITIONING SYSTEM DESIGN

Nominal duration

One module
It is anticipated that students will achieve the competencies specified in 35 to 40 hours.

Module codes

EB151

Discipline code

2. Module purpose

To provide the student with the knowledge and skills necessary to specify design criteria and considerations for various types of industrial air conditioning systems. The student will be able to specify zoning and usage requirements for a given application and describe the various types of appropriate air conditioning systems.

The student will also be able to describe various energy conservation techniques which may be incorporated in various system designs.

3. Prerequisites

EA131 - HVAC Control Systems 1
EA133 - Hydronic Systems
EA135 - Applied Psychrometrics

4. Relationship to competency standards

TBA

5. Content

1. Design parameters for multi-story building
   - customer and objective
   - customer concept of environment desired
   - economic
   - client brief

2. Relevant design criteria
   - building purpose, location, orientation and shape
   - external environment ambient conditions
   - internal load diversity
   - thermal capacity behaviour
   - thermal load (full and partial)

3. Zoning and building usage
   - space and building
   - occupancies, single purpose, multi-purpose

4. System selection criteria
   - economics
   - environment
   - control requirements

- existing structures
- new structures
- system components
- space for equipment and system
- selection of appropriate system

5. System and applications
   - design features, engineering procedures and controls for:
     - direct expansion - self contained room/zone, heat pump, mulit-zone fan-coils, central station
     - all water - room fan-coil
     - all-air - constant volume variable temperature, face and bypass, reheat, constant temp variable volume, constant volume induction, dual-duct, dual-conduit
     - air water - induction unit, primary air fan- coil

6. HVAC energy conversation techniques
   - heat recovery systems
   - night cycle
   - optimum stop/start
   - purge cycles
   - chiller/boiler/cooling tower sequencing
   - economy cycles (based on temperature or enthalpy)
   - supply air reset
   - supply water reset
   - condenser water temperature reset
   - power demand control
   - load limiting
   - load shedding
   - set point relaxation
   - ventilation cycles
   - plant - fixed OA to economy, boiler to electric reheat, constant volume to VAV etc.
   - cost-benefit (payback)

6. Learning outcome details

On the completion of this module, the learner will be able to:

Learning outcome 1

Specify design criteria and considerations for various types of air conditioning systems.

Assessment criteria

Short answer test.
Assignment.

1.1 Establish and list typical design parameters for large comfort and industrial air conditioning applications.

1.2 List and define all design criteria for large comfort and industrial air conditioning applications.

Learning outcome 2

Specify zoning and usage requirements for a given application and describe the various type of appropriate air conditioning systems.

Assessment criteria	Short answer test. Assignments/projects 2.1 List and define relevant building construction features and proposed building usage requirements that determine zoning of the air conditioning system. 2.2 Prepare system selection criteria to aid the selection of the most appropriate system for specific applications. 2.3 Prepare a list air conditioning system types typical of those used in large comfort and industrial air conditioning applications, and detail the system design features and suitable applications of each. 2.4 Given building construction features and proposed building usage requirements, determine zoning of the air conditioning system, and complete a summary of the system equipment arrangement.
Learning outcome 3	Describe various energy conversation techniques which may be incorporated in various system designs.
Assessment criteria	Short answer test. Assignment/projects. 3.1 Discuss and list external and internal impacts on building energy consumption and building design features which reduce heat loads on the building. 3.2 Describe the best current HVAC design strategies to reduce building energy consumption.
Learning outcome 4	Produce air conditioning designs for typical large scale plant to include multi-zone applications.
Assessment criteria	Projects. 4.1 Given a design brief, building floor and structural plans, and building heat load analysis, select the appropriate air conditioning system type. 4.2 Prepare a detailed design of the system, to include all equipment selections, arrangements and layouts, all air quantities and chilled water flow rates. 4.3 Demonstrate that sound energy conservation techniques have been employed in the design. 4.4 Prepare a cost analysis to provide the optimum balance between system thermal and acoustic performance, capital cost and running cost.

7. Assessment Strategies

See Assessment Criteria.

8. Module Delivery Strategies

This module contains learning outcomes that will require both theory and practical instruction. As such, it will require resources to facilitate both on and off-the-job delivery strategies.

These strategies may involve:

- co-operative registered off-the-job provider/employer delivery sharing available resources.
- delivery by an employer who is subregistered as an off-the-job provider, with qualified trainers in-house using resources to facilitate on and off-the-job delivery.
- off-the-job objectives should focus on the industry context while on-the-job objectives should reflect application within enterprise operations.

Assessment instruments will need to be developed by the module provider. These instruments will need to reflect consistency with stated module learning outcomes and related assessment criteria.

Student records will be the responsibility of the off-the-job provider and where more than one off-the-job provider is involved, formal processes for transfer of student information must be established.

9. Resource Requirements

AIRAH 1989, AIRAH Handbook.

AIRAH Design Aids

ASHRAE, Ashrae Handbook, Fundamentals, Atlanta.

ASHRAE, Ashrae Handbook, HVAC Systems, Atlanta.

AUBRCC 1990, Building Code of Australia, CSIRO, North Ryde.

Boyle, Australian Refrigeration and Air Conditioning, Trust Publications.

Carrier Air Conditioning Company, Handbook of Air Conditioning Design, McGraw - Hill.

Department of Housing and Construction, 197-, Carrier System Design Manual, AGPS

Jones, Air Conditioning Engineering

NATSPEC (latest edition). Natspec Volume 6 - Service Control

Monitoring Security, Refrigeration, Heating, Air Handling.

SMACNA 1987, HVAC Systems Applications

Standards Australia - Latest Editions to be used:
AS1668 parts 1&2. The use of Mechanical Ventilation and Air Conditioning in Buildings.

Stoecker W.F, Jones J.W., 1982. Refrigeration and Air Conditioning, McGraw-Hill.

The Trane Company 1986. Trane Air Conditioning Manual.

Additionally further information may be sourced from Journal Articles.

10. Occupational health and safety requirements

Learners must be made aware of all relevant OH&S issues in all situations and are required to demonstrate safe working practices at all times.

All work areas must comply with current OH&S legislation.