1. Module details

Module name

INDUSTRIAL REFRIGERATION SYSTEMS DESIGN 1

Nominal duration

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

Module codes

EA148

Discipline code

2. Module purpose

To provide the student with the knowledge and skills necessary to specify the type of refrigeration system suitable for a given application and to carry out basic system design procedures. Students will be able to select major system components and materials using manufacturer's data and calculate the system operating characteristics. Students will also be able to state the relevant Australian Standards, codes and regulations relating to industrial refrigeration system design.

3. Prerequisites

EA141 - Refrigeration Science
EA142 - Refrigeration System Analysis

4. Relationship to competency standards

TBA

5. Content

1. Standards and Codes:
   - AS1677, detailed understanding
   - AS 3666, overview
   - ozone protection regulations
   - IIAR Ammonia Data Book
   - ANSI/IIAR standards
   - ANSI/ASHRAE Mechanical Refrigeration & IIAR bulletins and standards (list will be provided by Rama)

2. Operating characteristics:
   - pH charts
   - refrigerating effect, relate back to air and fluid coolers
   - heat of compression, relate back to screw, rotary and reciprocating compressors
   - heat rejected high side of the system, relate back to air cooled, evaporative, and water cooled condensers
   - variable liquid refrigeration systems & liquid oversee systems
   - required mass flow rate of refrigerant and volume flow rate at various points in system
   - theoretical compressor power
   - required condenser capacity

3. Major system components
   - refrigerants, including R717 and R22
   - secondary refrigerants
   - component lubricant refrigerant compatibility
   - evaporators
   - condensers, cooling towers
   - compressors
   - expansion valves
   - interconnecting piping and
   - isolating valves
   - pilot operated valves
   - defrost system components for air, water, recycled water, hot gas, electric methods
   - refrigerant accumulators and liquid pumps

6. Learning outcome details

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

Learning outcome 1

State the relevant Australian Standards, codes and regulations relating to industrial refrigeration system design.

Assessment criteria

Open book short answer/multiple choice test.
Assignments.
Supervised practical, on the job exercises.

1.1 List the relevant Australian Standards, acts and industry codes and state how they impact on the design of industrial refrigeration systems.

1.2 Detail the relevant clauses and regulations, of the standards, codes and acts.

1.3 Define the legal responsibilities, including duty of care, of designers to comply with relevant sections of Australian Standards, codes and regulations.

Learning outcome 2

Calculate practical system operating characteristics.

Assessment criteria

Open book short answer/multiple choice test.
Assignments.
Supervised practical, on the job exercises.

2.1 Establish the expected or desired high, intermediate and low side pressures given full and partial refrigeration loads, desired room/evaporator temperature and conditions, expected ambient conditions, and likely plant equipment type.

2.2 Plot refrigeration cycle on pressure/enthalpy diagram including likely operating suction superheating, liquid subcooling and pressure drop at full and partial load conditions.

2.3 Using a cycle plot on a pH diagram and given both full and partial refrigeration loads, determine operating characteristics.

2.4 Take appropriate temperature and pressure readings from existing operating plants in order to plot the refrigeration cycle on pH diagrams including operating suction superheating, liquid subcooling and pressure drop at full and partial load conditions and determine operating characteristics.

Learning outcome 3

Select major system components and materials using manufacturer's data.

Assessment criteria

Assignments.
Supervised practical, on the job exercises.

3.1 Analyse system requirements, calculated operating characteristics, and by using manufacturer's data, catalogues, etc., select major system components to operate efficiently at full and part loads.

3.2 complete practical case studies of existing plants, and using relevant supplier's/manufacturer's data, establish effectiveness of the equipment selected.

3.3 Successfully complete projects in which major system components are selected.

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

Actrol Parts Catalogue & Technical Manual.

AIRAH 1989. AIRAH Handbook.

AIRAH. Design Aids.

ASHRAE. ASHRAE Handbook, Fundamentals, Atlanta.

ASHRAE. ASHRAE Handbook, Refrigeration Systems and Applications SI Version, Atlanta.

Boyle. Australian Refrigeration and Air Conditioning. Trust Publications.

Dossat R.J. Principles of Refrigeration. SI Edition, McGraw - Hill.

Lovelock Luke Refrigeration Catalogue.

Standards Australia - Latest Editions to be used:

ANSI/ARI410 Forced Circulation Air Cooling and Air Heating Coils.

AS1432 Copper Tube for Water Gas and Sanitation.

AS1571. Copper - Seamless Tubes for Air Conditioning and Refrigeration.

AS1677. Refrigeration Systems.

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

Additionally further information may be sourced from journal articles and extracts from of supplier's and manufacturer's catalogues.