



DIRECTORATE OF TECHNICAL EDUCATION  
DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME  
2015 -2016 onwards

III YEAR  
VI SEMESTER

ELECTIVE THEORY - II  
**32083 – REFRIGERATION AND AIRCONDITIONING**

CURRICULUM DEVELOPMENT CENTRE

## M-SCHEME

(Implements from the Academic year 2016-2017 onwards)

**Course Name** : Diploma in Mechanical Engineering  
**Course Code** : 1020  
**Subject Code** : 32083  
**Semester** : VI  
**Subject Title** : Refrigeration and Air-Conditioning

### TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			Duration
	Hours/ Week	Hours/ Semester	Marks			
Refrigeration and Air-Conditioning	5	75	<b>Internal Assessment</b>	<b>Board Examination</b>	<b>Total</b>	3 Hrs
			25	75	100	

### Topics and Allocation of Hours:

Unit	Topics	Hours
I	REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS	14
II	VAPOUR COMPRESSION & ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS	14
III	REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION	14
IV	PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS	13
V	COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES	13
	REVISION AND TEST	7
	Total	<b>75</b>

## **RATIONALE:**

Hence the study of refrigeration principles, system and its effectiveness are essential. Comfort is the basic requirement of customers and machines through air-conditioning and hence learning the concept of air-conditioning and methods of air-conditioning facilitates quality design of air conditioners.

## **OBJECTIVES:**

- Explain the working of open and closed air system of refrigeration.
- Describe the working and construction of compressors used for air conditioning.
- Explain vapour compression refrigeration system.
- Explain vapour absorption refrigeration system.
- Compare the properties and applications of various refrigerants.
- Define the parameters used in psychrometry.
- Use Psychrometry chart
- Describe the equipment used for air conditioning.
- Estimate the cooling load for the given requirement.
- Explain the industrial application of refrigeration.

## **REFRIGERATION AND AIR-CONDITIONING DETAILED SYLLABUS**

### **Contents: Theory**

<b>Unit</b>	<b>Name of the Topic</b>	<b>Hours</b>
<b>I</b>	<b>REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS</b>	<b>14</b>
	Thermodynamic state of a pure substance, modes of heat transfer – laws of heat transfer - mechanisms of production of cold - unit of refrigeration –types of refrigeration - reversed Carnot cycle - C.O.P of heat engine-heat pump- refrigerating machine – principle of working of open and closed air system of refrigeration – advantages and disadvantages – and its application of air cycle-problems Compressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors- condensers-principle of working and	

constructional details of air cooled and water cooled condensers, evaporative condensers- advantages and disadvantages - natural and forced draught cooling towers.

Evaporators- natural circulation and forced circulation type – principle of working constructional details.

## **II VAPOUR COMPRESSION REFRIGERATION SYSTEM ,VAPOUR ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS 14**

Principle of working of vapour compression system – analysis of vapour compression cycle using T-s diagram and p-H diagram- refrigerating effect- compression work - C.O.P - effect of superheating and under cooling – effect of evaporative pressure and condenser pressure-problems – liquid vapour refrigeration heat exchangers - advantages and disadvantages of superheating and under cooling – use of flash chamber and accumulator.

Simple absorption system – Electrolux system - solar absorption refrigeration system- absorption system comparison with mechanical refrigeration system.

Refrigerators for above 2 K- Philips Refrigerator--Giffered McMohan refrigerator- refrigerators for below 2 K - Magnetic refrigeration systems.

## **III REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION 14**

Capillary tube-automatic expansion valve-thermostatic expansion valve-electronic expansion valve-solenoid valve-evaporator pressure regulator –suction pressure regulator-classification of refrigerants- selection of a refrigerant-properties and applications of following refrigerants  $\text{SO}_2$ ,  $\text{CH}_4$ ,  $\text{F}_{22}$ , and  $\text{NH}_3$  –CFCs refrigerants- equivalent of CFCs refrigerants (R-123a,R-143a,R-69S)- blends of refrigerants(R400 and R500 Series) - lubricants used in refrigeration and their applications.

Slow freezing –quick freezing- cold storage-frozen storage-freeze drying –dairy refrigeration –ice cream cabinets-ice making – water

cooler, milk cooler, bottle cooler-frost free refrigeration.

#### **IV PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS 13**

Psychrometry properties - adiabatic saturation of air by evaporation of water- psychrometric chart and its uses – psychrometric processes – sensible heating and cooling - humidifying and heating - dehumidifying and cooling - adiabatic cooling with humidification - total heating or cooling processes -sensible heat factor - by pass factor – adiabatic mixing – evaporative cooling - problems – governing optimum effective temperature – comfort chart-design consideration.

Equipment for air conditioning and insulation factors – air purification – temperature control – humidity control – dry and wet filters- centrifugal dust collector – air washer humidifier – dehumidifier - fans and blowers – grills and registers – summer and winter air conditioning, window and split air conditioners — properties of ideal insulator, types of insulating materials .

#### **V COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES 13**

Different heat sources – conduction heat load – radiation load of sun – occupants load – equipment load - infiltration air load – miscellaneous heat sources –fresh air load - problems.

Classification of duct systems - Duct design – equal friction method – velocity reduction method – problems. Chilled water Systems -Air handling Units.

Energy conservation and design decisions - heat reclaim – thermal storage – ice builder – ice harvester – variable refrigerant flow (VRF) – variable primary flow (VPF).

#### **Text books :**

- 1) Refrigeration and air conditioning, P.L . Ballaney, Khanna Publishers, 2B, North Market, Naisarak, New Delhi 110 006.
- 2) Refrigeration and air conditioning, V.K. Jain,
- 3) Industrial Refrigeration Hand Book, Wilbert F. Steocker

**Reference Books:**

- 1) A course in refrigeration and air conditioning , Domkundwar,
- 2) Principles of refrigeration, Dossat ,
- 3) Home refrigeration and air conditioning, Audels, Theo.Audel & Co. publisher,  
199 Edn.49, West 23<sup>rd</sup> Street, New York. - 1998
- 4) Refrigeration and air conditioning, C.P Arora,
- 5) Cryogenic systems Randell Fd Barron.