

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 2023**

REFRIGERATION AND AIR CONDITIONING

[Note - 1. Steam tables and psychrometric chart are permitted
2. Missing data if any can be suitably assumed]

[Maximum Marks: **100**]

[Time: **3 Hours**]

PART-A

[Maximum Marks: **10**]

- I. (Answer *all* questions in one or two sentences. Each question carries **2** marks)
1. Define Latent heat.
 2. State the function of Accumulator in vapour compression refrigeration system
 3. What you meant by secondary refrigerants.
 4. Define saturated air.
 5. Classify Air conditioning systems on the basis of function. (5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

- II. (Answer *any five* of the following questions. Each question carries **6** marks)
1. Differentiate between refrigerator and heat pump with suitable diagrams.
 2. Compare Vapour compression refrigeration system and Vapour absorption System.
 3. Explain the working of double tube type water cooled condenser with suitable figure.
 4. Define the following:
(i) Dew point temperature (ii) Absolute humidity (iii) Relative humidity.
 5. Explain heating and humidification process and represent it on psychrometric chart.
 6. What are the factors affecting human comfort.
 7. Explain the working of summer air conditioning system with suitable figure. (5 x 6 = 30)

PART-C

[Maximum Marks: 60]

(Answer **one** full question from each Unit. Each full question carries **15** marks)

UNIT – I

- III. a. Derive COP of air refrigerator working on reversed Carnot Cycle. (7)
- b. The temperatures at the beginning and end of compression are -5°C and 151.8°C and that of expansion are 15°C and -53°C respectively in a Bell-Coleman air refrigeration cycle. Find the net work done / Kg on the air and COP of the cycle. Assume law for expansion $PV^{1.2}=C$, law for compression $PV^{1.4}=C$, specific heat of air at constant pressure = 1KJ/ KgK and R for air = 0.287 KJ/ KgK . (8)

OR

- IV. a. Explain Open and Closed cycle air refrigeration system. Also write the advantages of Closed cycle over Open cycle air refrigeration system. (7)
- b. In an Ammonia, vapour compression refrigeration plant, the evaporator temperature is -10°C and condenser temperature is 25°C . The refrigerant enters the evaporator as 0.1 dry and leaves the evaporator as 0.97 dry and there is no sub-cooling in condenser. After compression the vapour is super-heated by 30°C . Draw T-S and P-h diagram of the refrigerating cycle and find COP of the cycle. Use following properties of ammonia.

Sat. Temperature ($^{\circ}\text{C}$)	Enthalpy KJ/Kg	
	Liquid	Vapour
25	298.9	1465.84
-10	135.37	1433.05

Specific heat of Ammonia vapour: 2.8KJ/KgK (8)

UNIT – II

- V. a. Explain Automatic expansion valve with suitable sketch. (7)
- b. Explain the working of Electrolux refrigerator with flow diagram. (8)

OR

- VI. a. Explain the process of freeze drying. (7)
- b. Illustrate the working of Storage type water cooler with suitable figure. (8)

UNIT- III

- VII. a. How many tons of refrigeration are required to cool 120 m^3 of air per min at 30°C DBT and 60% RH to 20°C DBT and 80 % RH. (7)
- b. Derive expression for By-pass factor and efficiency of heating coil. (8)

OR

- VIII. a. Explain liquefaction of hydrogen with diagram. (7)
- b. 900 Kg/hr of return air at DBT 24°C and RH 60% mixes with 100 Kg/hr of fresh air of DBT 40°C and RH 30%. Find out specific humidity and specific enthalpy of return air and fresh air using psychometric chart and calculate specific humidity and specific enthalpy of mixture. (8)

UNIT - IV

- IX. a. The ambient and inside temperatures are 40°C and 20°C respectively for a room of Dimension $21 \times 11 \times 5$ meters. Calculate infiltrated heat load per hour. Take number of air changes per hour as 0.5. Take C_p for air = 1 KJ/KgK and R for air = 0.287 KJ/KgK . (7)
- b. Explain the construction and working of window type air conditioner with suitable figure. (8)

OR

- X. a. List various sources of heat gain in cooling load estimation. (7)
- b. Explain central air conditioning system with suitable layout. (8)
