

N.B.

1. **Question no.1 is compulsory.**
2. Attempt any *three* from question no. 2 to 6.
3. Use of Refrigerant Charts/Tables, Psychrometric charts, friction charts and steam tables are permitted

Q1) Attempt any *four*

- a) What are primary and secondary refrigerants? Explain the use of secondary refrigerant in Ice manufacturing plant. **05**
- b) What all can you do to make your building a GREEN BUILDING? **05**
- c) Why was the refrigeration and air conditioning regarded luxurious in the olden days? Is it luxurious now a days? Explain with examples in support of your arguments. **05**
- d) Describe briefly the working principle of a Vortex Tube Refrigeration **05**
- e) Explain the terms ODP & GWP. What are India's commitments in the Montreal Protocol? **05**

Q2) a) Discuss the effect of evaporator and condenser pressure on standard vapour compression system using p-h chart. **08**

b) The following data refer to a simple aircraft refrigeration system:

Ram Air temperature and pressure	: 30°C and 1 atm	12
Cabin air temperature and pressure	: 27°C and 1 atm	
Pressure at the exit of main compressor	: 4.5 bar	
ϵ = Heat Exchanger effectiveness cooling	: 0.8, $\eta_c = 0.84$, $\eta_e = 0.8$	
Load = 21kW		

Determine a) Tonnage, b) mass of air bled from main compressor for refrigeration, c) heat rejection, d) power, e) COP and f) power supplied to the blower.

Q3) a) A refrigeration system of 10TR capacity at an evaporator temperature of -12°C, needs a condenser temperature of 28°C. The refrigerant NH₃ is subcooled by 5°C before entering the expansion valve. The vapour is 0.95 dry when it leaves the evaporator. Using p-h chart for NH₃, find: **10**

1. Condition of vapour at the outlet of compressor
2. Condition of vapour at the entrance of evaporator
3. C.O.P.
4. Power Required

b) Derive the expression for equivalent diameter of a circular duct for a rectangular duct, when the quantity of air passing through the rectangular and circular duct is same. **10**

- Q4) a)** Explain with schematic the working of Lithium-Bromide Water refrigeration system. **10**
- b)** Moist air at 30°C, 1.01325 bar has a relative humidity of 80%. Determine without using psychrometric chart. **10**
1. Partial pressure of water vapour and air
 2. Specific humidity
 3. Specific volume and
 4. Dew Point Temperature
- Q5) a)** An air conditioned auditorium is to be maintained at 27°C dry bulb temperature and 60% RH. The ambient condition is 40°C dry bulb temperature and 30°C wet bulb temperature. The total sensible heat load is 100000KJ/h and the total latent heat load is 40000kJ/h. 60% of the return air is recirculated and mixed with 40% of make-up air after the cooling coil. The condition of air leaving the cooling coil is at 18°C. Determine: **10**
1. Room sensible heat factor
 2. The condition of air entering the auditorium
 3. The amount of make-up air
 4. Apparatus dew point
 5. BPF of cooling coil
- Show the process on the psychrometric chart.
- b)** Explain the condition of human comfort. What are the factors effecting human comfort? **06**
- c)** Explain different types of Expansion devices **04**
- Q6) Write short notes on any four** **20**
- a) Packaged Air Conditioners
 - b) Recent developments in variable refrigerant flow systems
 - c) Recent substitutes for refrigerants
 - d) Performance assessment parameters for cooling towers
 - e) BEE Star rating program

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