T.E. (Mechanical) (Sem-VI) (CB) Date-12/12/19

Paper / Subject Code: 89024 / Refrigeration and Air Conditioning

(Time: 3 Hours) **(Total Marks: 80)**

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: **12**

Ram Air temperature and pressure	: 30°C and 1 atm
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, ηc= 0.84, ηe=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 NH_3 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 NH_3, 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. **10**

Determine:

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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