Duration: 3hrs [Max Marks:80]

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.
(5) Use of Refrigerant tables, Friction charts, Psychometrics chart, and Steam table are permitted.

Qu.1   Attempt any Five of the following   [20]

a) Define: i) Ton of Refrigeration   ii) iii) Dry bulb temperature   iii) Wet bulb temperature iv) Humidity ratio

b) What are the properties of refrigerants? Compare primary and secondary refrigerant.

c) Define the term 'by pass factor' Express it for heating and cooling coil.

d) State the various applications of HVACR and explain any one application.

f) Explain working of Simple Vapor absorption system

g) Define the effective temperature. What are the physiological hazards resulting from heat?

h) State the types of Expansion device and explain working of any one with neat diagram.

Qu.2 a) Draw Schematic, P-H and T-s diagram of standard VCRS and discuss effect of Suction Pressure and Discharge Pressure on the performance of the VCRS.   [10]

b) A simple air refrigeration system is used for an aircraft to take a load of 20.TR. The ambient pressure and temperature are 0.9 bar and 22°C resp. The pressure of air is increased to 1 bar due to isentropic ramming action. The air is further compressed in a compressor to 3.5 bar and then cooled in a heat exchanger to 72°C. Finally, air is passed through the cooling turbine and then it is supplied to the cabin at a pressure of 1.03 bar. The air leaves the cabin at a temperature of 25°C. Assuming the isentropic efficiencies of the compressor and turbine are 80% and 75%. Find 1) Power required to take load in the cooling cabin. 2) COP of the system take Cp = 1.005 KJ/kg K and γ=1.4   [10]

Qu.3 a) A refrigerator uses R-134a as the working fluid and operates on ideal vapor compression refrigeration system. The evaporator and condenser pressure are 0.1 MPa and 0.8 MPa respectively. The mass flow rate of the refrigerant is 0.8 kg/sec. Determine the following: [10]

1) Rate of heat removal from the refrigerant space.
2) Input power to compressor.
3) Heat rejection rate in the condenser.
4) The COP
5) What would be the COP if compared with that of the Carnot refrigerator operating between 30°c and -10°C.

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b) The humidity ratio of atmospheric air at 28°C DBT and 760 mm of mercury is 0.016 kg/kg of dry air. Determine [10]
1) Partial pressure of water vapor
2) Relative humidity
3) Dew point temperature
4) Specific enthalpy
5) Vapor density.

Qu.4 a) Draw a neat sketch of Air Handling Unit showing each component. Also state functions of each component [06]
b) List and discuss various components used in Domestic refrigerator. [06]
c) What are the types of heat pump? Explain any one type with its application. [08]

Qu.5 a) Explain the working of air cooled, and water-cooled condenser [06]
b) The design conditions for an air-conditioned hall is: [14]
Outer conditions = 38°C DBT and 28°C WBT
Inside condition = 24°C DBT and 60% RH
Sensible heat load in room = 46.4 kW.
Latent heat load in room = 11.6 kW.
Total infiltration air 1200 m³/hr.
Apparatus due point temperature =10°C.
Quantity of recirculated air from the hall = 60%
If the quantity of recirculated air is mixed with the conditioned air after the cooling coil find the following.
a) The condition of air leaving the conditioner coil and before mixing with recirculated air.
b) The condition of air before entering the hall
c) The bypass factor of cooling coil
d) The refrigeration load on the cooling coil in tones of refrigeration

Qu.6 a) Write short note on (any two)
1) Types of Cooling towers, performance and selection [10]
2) Dairy and food processing plant
6) Explain working of commercial ice plant.
7) Discuss the method of duct design

b) Explain various psychrometric process with the help of psychrometric chart [10]

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