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7E7012

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B.Tech. VII Semester(Main/Back) Examination, November - 2019
Mechanical Engineering
7ME2A Refrigeration and Air Conditioning

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following suitable material is permitted during examination. (Mentioned in form no. 205)

1. Psychrometric charts - 2 nos.

Unit - I

1. a) Define one tonne of refrigeration. Derive relationship between C.O.P. of refrigerator and heat pump working on reversed carnot cycle and show the schematic diagram. **(8)**

b) Following results were obtained in a test conducted on a vapour compression refrigerator : Evaporator temperature = -28°C, Condenser pressure = 2.75 bar, Refrigerant leaving the condenser is 3°C superheat, refrigerant leaving the condenser is at 12.8°C. Determine the C.O.P. The following parameters are given : **(8)**

Pressure (bar)	Saturation temp. (°C)	Enthalpy (KJ/Kg)		Entropy (KJ/Kg)	Specific heat (KJ/Kg-K) at Constant pressure	
		Liquid	Vapour		Liquid	Vapour
2.75	14	438.48	802.9	5.5287	1.381	0.669
0.412	-28.5	381.58	783.24	5.6852	-	-

(OR)

1. a) Explain the effect of following on the performance of VCRS with the help of T - s and p - h chart.

   i) Decrease in evaporator pressure

   ii) Increase in condenser pressure

   iii) Suction vapor superheat

   iv) Sub - cooling of saturated liquid. **(8)**

   b) Explain with the help of neat sketch, the working of a refrigeration system having three evaporators at different temperatures with individual compression and multiple expansion valves. **(8)**

Unit - II

2. a) A dense air refrigeration cycle operates between 5 bar and 20 bar. The air temperature after heat rejection to surroundings is 37°C and air temperature at exit of refrigerator is 7°C. The isentropic efficiencies of compressor and turbine are 0.84 and 0.82 respectively. Determine

   i) Compressor and turbine work per tonne of refrigeration

   ii) C.O.P. **(10)**

   b) The higher we go, the cooler we find, then why aircrafts are air conditioned when they cruise at an altitude of 8500 metre. **(6)**

(OR)

2. a) An aircraft refrigeration plant has to handle a cabin load of 25 tonnes. The atmospheric temperature is 16°C. The atmospheric air is compressed to a pressure of 0.96 bar and temperature of 29°C due to ram action. This air is then further compressed in a compressor to 4.8 bar, cooled in a heat exchanger to 66°C, expanded in a turbine to 1 bar pressure and supplied to the cabin. The air leaves the cabin at a temperature of 26°C. The isentropic efficiency of both compressor and turbine are 0.9. Calculate

   i) The mass of air circulated per minute

   ii) C.O.P. (for air Take c_p = 1.005 KJ/Kg and γ = 1.4) **(10)**

   b) Draw schematic diagram of regenerative air refrigeration system and show it on T-s graph. **(6)**

Unit - III

3. a) With the help of neat sketch, Explain the principal and working of Electrolux Refrigerator. **(8)**

   b) Draw a neat sketch of simple vapour absorption refrigeration system. Derive formula for C.O.P. of an ideal vapour absorption system. **(8)**

(OR)

3. a) What are the desirable properties of an ideal refrigerant. Write the chemical formula for the refrigerant R - 11 and R 717. (8)

b) A single - stage single - acting reciprocating receiver has a bore of 180 mm and stroke of 270 mm. It receives vapor refrigerant at 1 bar and delivers it at 5 bar. If the compression and expansion follow the law $pV^{1.25}$ = constant and clearance volume is 5% of the stroke volume. Determine

i) The power required to derive the compressor if it runs at 600 r.p.m.; and

ii) The volumetric efficiency of the compressor. (8)

Unit - IV

4. a) Write a short note on the following :

i) Specific humidity

ii) Dew point temperature

iii) Wet bulb depression

iv) Adiabatic saturation process. (8)

b) In a cooling application, moist air enters a refrigeration coil at the rate of 100 Kg/min. at 35°C and 50% relative humidity. The apparatus dew point of coil is 5°C and bypass factor is 0.15. Using psychrometric chart, Determine

i) Outlet state of moist air

ii) Cooling capacity of coil in tones of refrigeration. (8)

(OR)

4. a) Define the term "Human Comfort". Explain the factors affecting human comfort. (8)

b) Define the term "Effective Temperature". Explain the factors governing effective temperature. (8)

Unit - V

5. a) With the help of neat sketch, explain the central air conditioning system. (8)

b) 250 m^3/min of air at atmospheric conditions 12°C DBT and 50% RH is supplied to an air - conditioned hall. The required conditions are 18°C DBT and 60% RH determine :

i) Sensible heat and latent heat removed from the air per minute

ii) Sensible heat factor for the system. (8)

(OR)

5. a) **With the help** of neat sketch, explain unitary air conditioning system. **(8)**

b) The air handling unit of an air conditioning plant supplies a total of 4500 m^3 min of dry air which comprises by weight 20 percent fresh air at 40°C DBT and 27°C WBT abd 80 percent recirculated air at 25°C and 50% RH. The air leaves the cooling coil at 13°C saturated state. Calculate the total cooling and room heat gain. **(8)**