SV-93

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B.E. (Mechanical) (Part-IV) (Semester - VII) (Revised) (New) Examination, April - 2018

REFRIGERATION AND AIR CONDITIONING

Sub. Code : 67501

Day and Date : Tuesday, 24 - 4 - 2018 **Total Marks : 100**

Time : 2.30 p.m. to 5.30 p.m.

Instructions :

1) **Attempt all questions.**
2) **Figures to the right indicate full marks.**
3) **Use same answer book.**
4) **Neat diagram must be drawn.**
5) **Use of steam table, refrigerant property table/chart & psychrometric charts are allowed.**
6) **Make suitable assumptions if required.**

Q1) Attempt any two:

a) i) How do you interprete second law of Thermodynamics with Refrigeration? **[4]**

ii) Discuss the limitations of Reversed Carnot cycle with gas a refrigerant. **[4]**

b) Necessity of cooling the Aeroplane. Discuss the internal and external heat sources contributing heat in Aeroplane compartment. **[8]**

c) The Carnot refrigerator requires 1.1 kw per tonne of refrigeration to maintain a region at a low temperature of -30°C. Determine; **[8]**

i) C.O.P.

ii) Higher temperature of the cycle.

iii) The heat rejected in kJ per ton of refrigeration.

Also calculate heat delivered and C.O.P when this device is used as heat pump.

P.T.O.

Q2) Attempt any two:

a) Describe with help of a block diagram and P-h polt a vapour compression refrigeration system using a heat exchanger for both superheating and subcooling of a refrigerator. **[9]**

b) What do you mean by Cryogenic Engineering? Explain applications of cryogenics in various fields. **[9]**

c) A vapour compression refrigeration plant works between pressure limits of 5.3 bar and 2.1 bar. The vapour is super heated by 5°C before entering the compress the temperature at the end of isentropic compression is 37°C. Assume C_p of vapour refrigerant as 0.63 kJ/kg-k. Determine C.O.P. of the plant condition of refrigerant at end of condentation is saturated liquid properties of Refrigerant as follows: **[9]**

Pressure (Bars)	Temperature (ts°C)	Enthalpy of fluid (h & kJ/kg)	Latent heat h & g. kJ/kg
5.3	15.5	56.15	144.9
2.1	–14.0	25.12	158.7

Q3) Attempt any two:

a) Discuss why CFC refrigerants needs to be phased out. Explain the ozone depletion and global warming issues. **[8]**

b) Describe properties of a good refrigerants. **[8]**

c) Explain the working of evaporative type condenser with a neat sketch. **[8]**

Q4) Attempt any two:

a) Define relative humidity (ϕ), degree of saturation (μ), dew point temperature and adiabatic saturation temperature. Derive the relation between ϕ and μ. **[8]**

b) The moist air is at 30°C,. The dew point, temperature is 15°C. The total pressure is 1 bar, Use steam table and calculate ϕ and μ. **[8]**

c) With help of psychrometric chart explain adiabatic mixing of moist air with infected water spray. Write only the governing equations for enthalpy and specific humidity. Draw the condition line with the help of $\left(\frac{\Delta h}{\Delta w}\right)$ protector given on the chart. **[8]**

Q5) Attempt any two:

a) Explain the factors affecting By-Pass factor. Apparatus due point and coil rating with the help of psychrometric chart. Also write only the equations for air quantity over a coil using ESHF, ADP and B. F. [9]

b) Explain only the body regulatory process against heat and cold. Draw neat sketch of comfort chart giving the numerical values. [9]

c) Air conditioning system is used for a Bank with following details: [9]

No. of persons = 100.

Ventilation requirement 0.0047 m^2/sec per person.

Out door design condition, DBT = 37°C, WBT = 27°C.

Indoor condition desired R. H. = 60% & DBT = 22°C

Room sensible heat load = 4,00,000 kJ/h.

Room latent heat load = 2,00,000 kJ/h.

By-pass factor = 0.15. Calculate:

Grand total heat, ESHF, A.D.P. amd quantity of detrumidified air supplied to the Bank.

Q6) Attempt any two:

a) Explain sources of heat load for air conditioning system. Write only essential equations. [8]

b) Explain duct sizing methods by using suitable charts. [8]

c) Explain room air distribution requirements. Write a note on types of outlets used for supply and distribution. [8]