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Reg. No. : .....

Name : .....

Seventh Semester B.Tech. Degree Examination, June 2018
(2008 Scheme)
08.704 : REFRIGERATION AND AIR CONDITIONING (M)

Time : 3 Hours Max. Marks : 100

Instructions : 1) ***Use*** *of Psychometric chart and refrigeration tables are* ***permitted***.
2) *Answer* ***all*** *questions from Part – **A**. **Each** carries **4** marks. And **one full** question from **each** Module of Part – **B**. **Each** carries **20** marks.*

PART – A

1. Describe with a schematic diagram and draw the T-S representation of the processes of boot-strap evaporation type aircraft refrigeration system.

2. State the functions of the following parts of a simple vapour compression system :
   i) Compressor,
   ii) Condenser,
   iii) Expansion valve,
   iv) Evaporator.

3. Explain two stage compression with intercooling and sub-cooling by external cooling source.

4. List the applications of thermoelectric refrigeration system.

5. Mention the function of each fluid in a three – fluid vapour absorption system.

6. What are the advantages and disadvantages of steam jet refrigeration system over other types of refrigeration systems ?

P.T.O.

7. State how will you carry out 'leak detection' in the following refrigerant ?
   i) Ammonia and
   ii) R-12 (Freon – 12).

8. Write a short note on 'by-pass factor'.

9. State and explain factors which govern optimum effective temperature.

10. Explain with a neat diagram the working of central system of air-conditioning.

(10×4=40 Marks)

PART – B

Module – I

11. A single compressor, using Freon-12 as refrigerant, has three evaporators of capacities 9 tonnes, 27 tonnes and 18 tonnes of refrigeration. The temperatures in all the three evaporators is to be maintained at –5°C. The vapours leaving the evaporators are dry saturated. The condenser temperature is 40°C. The liquid refrigerant leaving the condenser is sub-cooled to 30°C. Assume isentropic compression, find the following :
   i) Power required to drive the compressor,
   ii) Coefficient of performance of the system.

12. A heat pump using ammonia as the refrigerant operates between saturation temperatures of 6°C and 36°C. The refrigerant is compressed isentropically from dry saturation and there is 6 K of under-cooling in the condenser. Calculate :
   i) $C.O.P._{(heat\ pump)}$,
   ii) The mass flow of refrigerant, and
   iii) The heat available per kilowatt input.

Module – II

13. A single-stage single-acting reciprocating compressor has a bore of 200 mm and a stroke of 300 mm. It receives vapour refrigerant at 1 bar and delivers it at 5.5 bar. If the compression and expansion follow the law $PV^{1.3}$ = Constant and clearance volume is 5% of the stroke volume, determine :
   i) The power required to drive the compressor, if it runs at 500 rpm and
   ii) The volumetric efficiency of the compressor.

14. The data relate to a steam jet refrigeration system : Temperature of the cold water to be supplied to an industrial plant = 10°C, Temperature of make-up and recirculated water = 25°C, Condition of motive steam = 8.5 bar, 190°C, Quality of vapour leaving the flash chamber and entering the ejector = 0.95, Condenser pressure = 60 mm of Hg, Nozzle efficiency = 93%, Entrainment efficiency = 65%, Compression efficiency = 75%, Quality of steam and flash vapour at the beginning of compression = 0.918. Determine the following :
    i) Mass of motive steam required to produce unit mass of flash vapour at 10°C,
    ii) Total motive steam required to produce 1 tonne of refrigeration per hour, and
    iii) C. O. P. of the system.

Module – III

15. The pressure and temperature of the air in a room is 1 bar and 28°C. If the relative humidity is found to be 30%, determine :
    i) The partial pressure of the water vapour and dew point,
    ii) The specific volume of each constituent, and
    iii) The specific humidity.

16. For a hall to be conditioned, the following conditions are given : Outdoor condition = 40°C DBT, 20°C WBT, Required comfort condition = 20°C DBT, 60% RH, Seating capacity of hall = 1500, Amount of outdoor air supplied = 0.3 m^3/min per person. If the required condition is achieved first by adiabatic humidification and then by cooling, determine :
    i) Capacity of the cooling coil in tonnes and
    ii) Capacity of the humidifier in kg/h. **(3×20=60 Marks)**