BE/mech/CBGS/sem VIII/RAC /09-12-2016

Refrigeration & Air Conditioning

Q.P. Code : 731000

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

(Revised course)

Note: 1) Question no. **1** is compulsory.

2) Attempt any **three** questions out of the remaining **five** questions.

3) Clearly mention the assumptions made if any.

4) Use of Refrigerant tables, P-h Chart, Friction charts, Psychrometric chart, and Steam table are permitted.

Q 1 Answer the following **20**

a) Define i) Relative humidity, ii) Ton of refrigeration, iii) Degree of saturation, iv) Dew point temperature v) Coefficient of performance.

b) Draw P-H and T-S diagram when the vapours are superheated at the end of compression and with under cooling of liquid.

c) What is effective temperature? Which are the factors governing effective temperature?

d) Explain ASHRAE numbering system for refrigerants with example.

e) Atmospheric air at 10°C WBT and 15°C DBT enters a heating coil whose temperature is 40°C DBT. The bypass factor of heating coil is 0.4. Determine DBT, WBT and RH of the air leaving the coil and the amount of sensible heat added per kg of air.

Q 2 a) For a sample of air having 22°C DBT, Relative humidity 30% at barometric pressure of 760 mm of Hg, Calculate i) Vapour pressure ii) Vapour density iii) Humidity ratio iv) Enthalpy. **8**

b) Explain the working principle of thermostatic expansion valve with the help of neat diagram. **6**

c) Describe vapour absorption refrigeration system using three fluids. **6**

Q 3 a) An air cooling system for a jet plane cock pit operates on the simple cycle. The cockpit is to be maintained at 25°C. The ambient air pressure and temperature are 0.35 bar and -15°C respectively. The pressure ratio of the jet compressor is 3. The plane speed is 1000 km/hr. The air is passed through a heat exchanger after compression and cooled to its original condition entering into the air jet. The pressure loss in heat exchanger is 0.1 bar. The pressure of air leaving the cooling turbine is 1.013 bar and is also the pressure in the cockpit. The cooling load in the cockpit is 70 kW. Determine i) Mass flow rate of air circulated to the cabin. ii) Net power delivered to the refrigeration system. iii) The COP of the system. **12**

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b) Explain with neat sketch a complete multistage vapour compression system 4

c) What are the general rules to be followed in the design of ducts? 4

Q 4 a) A vapour compression system using R12 works between -15°C and 35°C as evaporator and condenser temperature respectively. Using P-H chart determine i) COP ii) Mass flow of refrigerant per TR iii) Piston displacement per TR using volumetric efficiency = 80% iv) Heat rejected in the condenser per TR. 12

b) Explain cascade system of refrigeration. 4

c) What are the different types of compressors used in refrigeration and air conditioning practice ? Discuss them. 4

Q 5 a) The design conditions for an air conditioned hall is

Inside condition	24°C DBT and 60% RH
Outside condition	38°C DBT and 28°C WBT
Sensible heat gain	167040 kJ/hr
Latent heat gain	41760 kJ/hr
Infiltrated air	20 CMM
Coil ADP	10°C

60% of total air is recirculated and mixed with conditioned air after cooling coil. Determine i) The condition of air before entering the hall ii) The condition of air leaving the conditioner coil ii) BPF of cooling coil iv) refrigeration load on cooling coil. 14

b) Describe cooling towers with important performance related terms. 6

Q 6 a) Aspect ratio of a rectangular duct is 7 and its equivalent circular duct diameter is 100 mm. The ratio of longer side of rectangular duct to the diameter of circular duct is 2.6. Find the dimension of shorter side of the duct. 6

b) What is secondary refrigerant? Where it used? Explain its importance in big ice plant. 6

c) Write short note on (any two) 8

i) Deep sea water air conditioning

ii) Vortex tube refrigeration

iii) Noise and its controls in A/C system

iv) Dairy and food processing plant