Code: 13A03603 **R13**

B.Tech III Year II Semester (R13) Supplementary Examinations December 2016

REFRIGERATION & AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

Use of refrigeration and air conditioning data hand book and steam tables are permitted in the examination hall.

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What are the reasons why temperature of cabin of aircraft goes up?
(b) Define ton of refrigeration.
(c) Define sub-cooling.
(d) What are the methods to improve the COP of VCR?
(e) What is the basic difference between vapour compression and vapour absorption refrigeration system?
(f) Define refrigerant.
(g) What is dew point temperature?
(h) Define RSHF line.
(i) Define humidification.
(j) Differentiate between heat pump and refrigerator.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) When the Brayton cycle is reversed and operated as a refrigerator, show that the ideal COP of such cycle is given by: COP = $1/[(p_2/p_1)^{(\gamma-1/\gamma)}-1]$.

(b) A Carnot refrigeration requires 1.3 kW per ton of refrigeration to maintain a temperature of -40°C. Determine: (i) COP of the refrigeration. (ii) The temperature at which the heat is rejected. (iii) The amount of heat rejected in kJ/min. (iv) COP, if the cycle used as a heat pump.

OR

3 Explain with neat sketch air refrigeration system. Draw P-V and T-S diagram.

UNIT – II

4 (a) Explain with T-S diagram effect of super heating.

(b) An Ammonia refrigerator works between -6.7°C to 26°C. The vapour is dry saturated at the end of the compression. Calculate: (i) Theoretical COP. (ii) Power required to run the compressor if the cooling capacity of the refrigeration is 5 tons. Use following properties of NH_3

Temperature (°C)	Specific enthalpy (kJ/kg)		Specific entropy (kJ/kg-K)	
	Liquid (h_f)	Saturated vapour (h_g)	Liquid (s_f)	Saturated vapour (s_g)
-6.7	-29.26	1262.36	0.1087	4.7401
26	124.26	1291.62	0.4264	4.3263

OR

5 (a) Derive an expression for maximum COP by Ewing analysis.

(b) A refrigerator plant using CO_2 as refrigerant works between 25°C to -5°C. The dryness of CO_2 is 0.6 at the entry of compressor. Find the ice formed per day if the ice is formed at 0°C from water 10°C, quantity of CO_2 circulated is 10 kg/min.

C_{pw}=4.187 kJ/kg-K, h_{fg}(ice)= 335 kJ/kh.

Take relative η = 0.6 and following properties of CO_2

Temperature (°C)	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Liquid entropy (kJ/kg-K)
25	81.25	121	0.2513
-5	-7.53	245.8	-0.0419

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UNIT – III

6 (a) Explain with neat sketch Lithium-Bromide absorption refrigeration system.

(b) What are the advantages of absorption refrigeration over compression refrigeration system?

OR

7 (a) Explain with neat sketch steam jet refrigeration system.

(b) In an absorption refrigeration system heating, cooling and refrigeration take place at the temperatures of 150^{o}C, 30^{o}C and -20^{o}C. Find the theoretical COP of the system. If the heating temperature is increased to 200^{o}C and refrigeration temperature is decreased to -40^{o}C, find the percentage change in theoretical COP.

UNIT – IV

8 (a) Explain summer air conditioning system with neat sketch.

(b) 5 gram of water vapour per kg of atmospheric air is removed and temperature of air after removing the water vapour becomes 25^{o}C DBT. Find relative humidity and dew point temperature. Assume condition of atmospheric air is 35℃ and 60% RH and pressure is 1.013 bar.

OR

9 (a) Explain with psychometric chart:
(i) Sensible heating. (ii) Sensible cooling. (iii) Cooling with dehumidification.

(b) The DBT and WBT of air are 35℃ and 23℃ respectively, when barometric reading is 74.5 cm of Hg.
Find: (i) Relative humidity.
(ii) Specific humidity.
(iii) Dew point temperature.

UNIT – V

10 (a) Explain with neat sketch dry filter.

(b) Explain with neat sketch forward blade, backward blade and radial blade fans.

OR

11 (a) Explain with neat sketch atomization type humidifier.

(b) Explain with neat sketch how dehumidification takes place by refrigeration.

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