J.C Bose University of Science and Technology, YMCA Faridabad

December, 2019

B.Tech. V SEMESTER

Refrigeration and Air Conditioning (ME-303C)

Time: 3 Hours **Max. Marks:75**

Instructions:
1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Use of Refrigeration table and Psychrometric Chart is allowed*

PART -A

Q1 (a) What are the desirable properties of an ideal refrigerant? (1.5)

(b) Explain the term "tonne of refrigeration". (1.5)

(c) What is the effect of degree of superheating and degree of subcooling on COP of vapour compression refrigeration system? (1.5)

(d) What are the advantages of multistage compression with intercooler over single stage compression? (1.5)

(e) How the function of compressor is achieved in vapour absorption refrigeration system (1.5)

(f) Define the term dew point temperature and degree of saturation. (1.5)

(g) Show the process of cooling and dehumidification on psychrometric chart. (1.5)

(h) What are the different factors to be considered in load estimation sheet for comfort application? (1.5)

(i) Write the classification of duct. (1.5)

(j) On what factors does the volumetric efficiency of a compressor depend? (1.5)

PART -B

Q2 (a) Explain the working of a bell-Coleman cycle and derive its COP. Also show the various processes on P-V and T-S diagram (8)

(b) Explain, with a neat sketch, the working of a simple air evaporative cooling system. (7)

Q3 An ammonia refrigerating machine fitted with an expansion valve works between the temperature limits of -10°C and 30°C. The vapour is 95% dry at the end of isentropic compression and the fluid leaving the condenser is at 30°C. Assuming actual COP as 60% of the theoretical, calculate the kilograms of ice produced per kW hour at 0°C from water at 10°C. Latent heat of ice is 335 kJ/kg. (15)

Temperature °C	Liquid heat (h_f) kJ/kg	Latent heat (h_{fg}) kJ/kg	Liquid entropy (s_f) KJ/kg K
30	323.08	1145.8	1.2037
-10	135.37	1297.68	0.5443

Q4 Explain with the help of a neat sketch, the working of a refrigerating system having three evaporators at different temperatures with individual compressors and multi expansion valves. (15)

Q5 (a) Draw a neat a neat diagram of lithium bromide water absorption system and explain its working. List the major field of applications of this system (8)

(b) Explain with a neat sketch, the working of a steam jet refrigeration system (7)

Q6 A conference room for seating 100 persons is to be maintained at 22°C dry bulb temperature and 60% relative humidity. The outdoor conditions are 40°C dry bulb temperature and 27° C wet bulb temperature. The various loads in the auditorium are as follows: (15)

Sensible and latent heat loads per person, 80 W and 50 W respectively ;lights and fans, 15 kW; sensible heat gain through glass, walls, ceiling etc., 15kW. The air infiltration is 20m³/min and fresh air supply is 100 m³/min. Two-third of recirculated room air and one third of fresh air is mixed before entering the cooling coil. The by-pass factor of the coil is 0.1.

Determine apparatus dew point, the grand total heat load and effective room sensible heat factor.

Q7 Write short notes on: (5x3)

(i) Thermodynamic Wet Bulb temperature

(ii) Summer air conditioning system

(iii) Different types of compressor used in refrigeration

****