

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

December, 2019

B.Tech. V SEMESTER

Refrigeration and Air Conditioning (ME-303C)

Max. Marks:75

Time: 3 Hours

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  $-10^{\circ}\text{C}$  and  $30^{\circ}\text{C}$ . The vapour is 95% dry at the end of isentropic compression and the fluid leaving the condenser is at  $30^{\circ}\text{C}$ . Assuming actual COP as 60% of the theoretical, calculate the kilograms of ice produced per kW hour at  $0^{\circ}\text{C}$  from water at  $10^{\circ}\text{C}$ . Latent heat of ice is 335 kJ/kg. (15)

Temperature $^{\circ}\text{C}$	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 (15)  
having three evaporators at different temperatures with individual compressors and multi expansion valves.
- Q5 (a) Draw a neat diagram of lithium bromide water absorption system and (8)  
explain its working. List the major field of applications of this system  
(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  $22^{\circ}\text{C}$  dry (15)  
bulb temperature and 60% relative humidity. The outdoor conditions are  $40^{\circ}\text{C}$   
dry bulb temperature and  $27^{\circ}\text{C}$  wet bulb temperature. The various loads in the  
auditorium are as follows:  
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  $20\text{m}^3/\text{min}$  and fresh air supply is  $100\text{m}^3/\text{min}$ . 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

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