

**FACULTY OF ENGINEERING**  
**B.E. 3/4 (M/P) II – Semester (Main) Examination, June 2014**

**Subject: Refrigeration and Air-conditioning**

Time: 3 Hours

Max.Marks: 75

**Note: Answer all questions from Part A. Answer any five questions from Part B.**

**PART – A (25 Marks)**

- 1 What are the advantages of secondary refrigerants? (2)
- 2 Distinguish between dense air refrigerating system over open air refrigeration system. (3)
- 3 List the advantages of vapour compression system over air refrigeration system. (2)
- 4 Explain the working principle of two stage compression system with liquid inter-cooler. (3)
- 5 What is the function of rectifier and analyzer? (2)
- 6 Why steam jet refrigeration system cannot be used below subzero temperature? List the limitations of steam jet refrigeration system. (3)
- 7 What is the difference between “wet bulb temperature” and “thermodynamic wet bulb temperature”. (3)
- 8 What factors are to be considered for “effective temperature”? (3)
- 9 Define “Apparatus Dew point temperature”. (2)
- 10 State advantages of modern transport air conditioning system. (3)

**PART – B (50 Marks)**

- 11 An aircraft moving with a speed of 1000 km/h uses simple gas refrigeration cycle for air conditioning. The ambient pressure and temperature are 0.35 bar and  $-10^{\circ}\text{C}$  respectively. The pressure ratio of compressor is 4.5. The heat exchanger effectiveness is 0.95. the isentropic efficiencies of compressor and expander are 0.8 each,. The cabin pressure and temperature are 1.06 bar and  $25^{\circ}\text{C}$ . Determine temperatures and pressures at all points of the cycle. Also find the volume flow rate through compressor inlet and expander outlet for 100 TR. Take  $C_p = 1.005 \text{ kJ/kg K}$ ;  $R = 0.287 \text{ kJ/kg K}$  and  $C_p/C_v = 1.4$  for air. (10)
- 12 A vapour compression refrigerator uses R-12 as refrigerant and the liquid evaporates in the evaporator at  $-15^{\circ}\text{C}$ . The temperature of this refrigerant at the delivery from the compressor is  $15^{\circ}\text{C}$  when the vapour is condensed at  $10^{\circ}\text{C}$ . Find the C.O.P. if the liquid is subcooled by  $5^{\circ}\text{C}$  before expansion by throttling. Take specific heat for super heated vapour as  $0.64 \text{ kJ/kg K}$  and for liquid as  $0.94 \text{ kJ/kg K}$ . The other properties of refrigerants take from the refrigeration table. (10)
- 13 (a) Explain with sketch the working of lithium-bromide vapour absorption system. (6)  
 (b) Explain the cooling principle of pulse tube refrigeration system. (4)
- 14 An air conditioned system is designed under the following conditions:
 

Outdoor conditions	$30^{\circ}\text{C}$ DBT, 75% RH
Required indoor conditions	$22^{\circ}\text{C}$ DBT, 70% RH
Amount of free air circulated	$3.33 \text{ M}^3/\text{S}$
Coil-dew point temperature	$14^{\circ}\text{C}$

The required condition is achieved first by cooling and dehumidification and then heating.

Estimate:

- a) The capacity of cooling coil in tons
  - b) Capacity of heating coil in tons
  - c) Amount of water removed in Kg/S
  - d) Draw the psychrometric chart for above mentioned processes. (10)
- 15 (a) Discuss briefly the different types of heat loads which have to be taken into account in order to estimate the total heat load of a large restaurant for summer air conditioning (6)
- (b) Describe the different methods of air conditioning duct design. Why are dampers required in some systems? (4)
- 16 (a) Discuss the significances of figure of merit in thermo electric refrigeration. State the factors governing the value of figure of merit. (6)
- (b) State the four desirable properties of a good thermo electric material. (4)
- 17 (a) Draw a neat diagram of air-conditioning system required for winter season. Explain the working of different components in the circuit. (6)
- (b) Explain with psychrometric chart the procedure to draw a grand sensible heat factor line on a psychrometric chart. (4)

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