

(3 Hours)

[Total Marks : 80

- N.B. :** (1) Solve any **four** questions.
(2) **Figures** to the right indicate **full** marks.
(3) Assume suitable data wherever necessary and mention it clearly.
(4) Answers to the sub question of an individual question should be written together and one below other.
(5) Use of Refrigerant Charts, Psychrometric Chart and Steam Tables is allowed.
(6) **All** questions carry **equal** marks.

1. a) A two stage compression Ammonia refrigeration system with water and flash intercooling and water sub-cooling operates between the overall pressure limits of 13.89 bar and 1.9 bar. The flash intercooler pressure is 4.97 bar. The temperature of refrigerant leaving the water intercooler and the water subcooler is limited to 30 C. If the load is 20 TR; find (i) COP of the system; (ii) power required to drive each compressor; and (iii) swept volume for each compressor, assuming the volumetric efficiency for both the compressors as 80 %. **10**
- b) Explain with the help of a neat sketch, the working of a refrigerating system having three evaporators at different temperatures with individual compressors and multiple expansion valves. **5**
- c) What is subcooling and superheating ? Explain with the help of diagram. Why is superheating considered to be good in certain cases ? **5**
2. a) Describe adiabatic mixing of two air streams resulting in condensation. 300 m³/min air at 1 °C DBT and 90 % RH is mixed with 100 m³/min of air at 30°C DBT and 27 °C WBT. Determine the condition of mixture. **10**
- b) Explain how to estimate the cooling load of your College library. Hence define RSJF, GSJF and explain how to draw RSJF and GSJF lines. Clearly mention the assumptions made if any. **10**
3. a) The following observations are made in an airconditioned space **10**
Outside design 35 C DBT, 28 C WBT
Inside design 25 C DBT, 50 % RH
Room Sensible Load 43 kW; Room Latent Load 8 kW
Ventilation air 60 m³/min
BF of coil 0.2
Determine: i) Room ADP ii) Temperature of air leaving the coil iii) Total quantity of air iv) Temperature of air entering the coil v) Coil ADP

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- b) Compare Li-Br- Water and Ammonia-Water Vapour Absorption Refrigeration systems. 5
- c) Draw neat sketches and explain DX and Flooded Evaporators. 5
4. a) What are non conventional HV AC systems ? Explain in details any one of them. 10
- b) Explain the terms ODP and GWP giving examples of different refrigerants. 5
- c) What is the new technology development in refrigeration compressors ? Discuss in brief with an example. 5
5. a) In a vapour compression refrigeration system using R-12, the evaporator pressure is 1.4 bar and the condenser pressure is 8 bar. The refrigerant leaves the condenser subcooled to 30°C. The vapour leaving the evaporator is dry and saturated. The compression process is isentropic. The amount of heat rejected in the condenser is 13.42 MJ/min. Determine : i. Refrigerating effect in kJ/Kg ; ii. Refrigerating load in TR; iii. Compressor input power in kW; and iv. COP. 10
Show the cycle on P-h diagram.
- b) Draw a neat sketch of a Year Round Air Conditioning system and explain each component in detail. 10
6. Write short note on any 4 : 20
- Pressure and Temperature Controls
 - Railway Coach Air Conditioning
 - Green Buildings
 - Natural Refrigerants
 - ASHRAE Comfort Chart
 - Cooling Towers