

- N. B. :**
- (1) Question No. 1 is **compulsory**.
  - (2) Attempt any **four** questions out of remaining **six** questions.
  - (3) **Clearly** mention the assumptions made if any.
  - (4) Use of refrigerant tables, friction charts, psychrometric chart, steam table are **permitted**.

1. (a) Define ton of refrigeration. Name the different types of systems used for cooling of the aircraft cabin. 4
- (b) What is sling psychrometer ? Make a neat sketch and explain its use. 4
- (c) Explain the effect of suction pressure with the help of p-h diagram in Vapour compression system. 6
- (d) Atmospheric air with dry bulb temperature of 28°C and a wet bulb temperature of 17°C is cooled to 15°C without changing its moisture content. Find (i) Original relative humidity; (ii) Final relative humidity and (iii) Final wet bulb temperature. 6
  
2. (a) In an open air refrigeration machine, air is drawn from a cold chamber at -2°C and 1 bar and compressed to 11 bar. It is then cooled at this pressure, to the cooler temperature of 20°C and then expanded in the expansion cylinder and returned to the cold room. The compression and expansion are isentropic, and follows the law  $pv^{1.4} = \text{constant}$ . Sketch the p-v and T-s diagrams of the cycle and for a refrigeration of 15 tonnes. Find (i) theoretical C.O.P; (ii) rate of circulation of air in kg/min; (iii) piston displacement per minute in the compressor and expander; and (iv) theoretical power per tonne of refrigeration. 8
- (b) Draw a neat diagram of electrolux refrigeration system and explain its working. 6
- (c) Discuss the limitations of vapour compression refrigeration system for production of low temperature. 6
  
3. (a) For a sample of air having 22°C DBT, relative humidity 30 percent at barometric pressure of 760mm of Hg, Calculate : 8
  - (i) Vapour pressure      (iii) Humidity ratio,
  - (ii) Vapour density and (iv) Enthalpy.
- (b) Explain the working principle of thermostatic expansion valve with the help of neat diagram. 6
- (c) Compare primary refrigerants with secondary refrigerants. 6

[ TURN OVER

**Con. 5872-GT-8745-10.****2**

4. The room sensible and latent heat loads for an air conditioned space are 25kW and 5kW respectively. The room condition is 25°C dry bulb temperature and 50% relative humidity. The outdoor condition is 40°C dry bulb temperature and 50% relative humidity. The ventilation requirement is such that on mass flow rate basis 20% of fresh air is introduced and 80% of supply air is recirculated. The by-pass factor of the cooling coil is 0.15. **20**
- Determine :
- Supply air flow rate;
  - Outside air sensible heat;
  - Outside air latent heat;
  - Grand total heat; and
  - Effective room sensible heat factor.
5. (a) Explain a complete multistage compression system. **10**  
 (b) Explain working of forced draft cooling tower and explain effect of ambient temperature and humidity on performance of cooling tower. **10**
6. (a) Derive an expression for the equivalent diameter of circular duct corresponding to a rectangular duct of sides a and b, for the same pressure loss per unit length, when (i) the quantity of air passing through both the ducts is same, and (ii) the velocity of air flowing through both the ducts is same. The friction factor remains the same for both the ducts. **12**  
 (b) Explain bootstrap air refrigeration cycle with a schematic diagram and show the cycle on T-s diagram. **8**
7. Write short notes on any **four** of the following :— **20**
- Controls used in Air Conditioning
  - Defrosting
  - Food Preservation
  - Capillary Tube
  - Commercial ice making.