

Q.P. Code :13784

(Revised course)

[Time: Three Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Question no. 1 is compulsory.
 2. Attempt any three questions out of the remaining five questions.
 3. Clearly mention the assumptions made if any.
 4. Use of Refrigerant tables, Friction charts, Psychrometric chart, and Steam table are permitted.

- Q.1 Answer the following questions
- a) Define i) Refrigeration ii) Ton of Refrigeration iii) Air Conditioning iv) Coefficient of Performance. **04**
 - b) Explain difference between vapour compression refrigeration system and vapour absorption refrigeration system. **04**
 - c) Name the different types of air refrigeration systems used for the cooling of the aircraft cabin. Draw bootstrap air refrigeration cycle with neat schematic and T-S diagram. (6) **06**
 - d) What are the desirable properties of refrigerants? Compare primary and secondary refrigerants **06**
- Q.2 a) Discuss the effect of change in evaporator and condenser pressure on the performance of standard VCR cycle with the help of P-h diagram. **06**
- b) The following data refers to simple air refrigeration cycle of 20 TR capacity **14**
 Ambient air temperature and pressure = 20°C and 0.8 bar.
 Ram air pressure = 0.9 bar
 Compressor outlet pressure = 3.6 bar
 Temperature of air leaving H.E. = 60°C
 Pressure of air leaving the turbine = 1 bar
 Temperature of air leaving the cabin = 22°C
 Compressor and Turbine efficiency = 80% and 75% resp.
 Assume no pressure drop in H.E. and isentropic ramming process. Calculate net power required and COP of the system.
- Q.3 a) A vapour compression system using R12 works between -15 °C and 35 °C as evaporator and condenser temperature resp. Using P-h chart determine; **12**
- i. COP
 - ii. Mass flow of refrigerant per TR
 - iii. Piston displacement per TR using volumetric efficiency 80%
 - iv. Heat rejected in the condenser per TR
 - v. Ideal COP
- b) What are the types of expansion valves? Explain the working of thermostatic expansion valve **08**
- Q.4 a) Discuss various psychrometric processes that can be achieved by using an air washer **10**
 b) Explain the various methods of duct design. **10**
- Q.5 a) The room sensible and latent heat loads for an air conditioned space are 50 kW and 10 kW respectively. **14**
 The room condition is 26 °C dry bulb temperature and 50 % relative humidity. The outdoor condition is **(P.T.O)**

37 °C dry bulb temperature and 45 % relative humidity. The ventilation requirement is such that on mass flow rate basis 20 % fresh air is introduced and 80 % of supply air is recirculated. The bypass factor of the cooling coil is 0.15. Determine:

- i. Supply air flow rate
- ii. Outside air sensible heat
- iii. Outside air latent heat
- iv. Grand total heat; and
- v. ERSHF

b) Classify different types of Compressors. Explain each type in brief.

06

Q.6 Write short notes on any four of the following:

20

- a) Central air conditioning system.
- b) LiBr-Water vapour absorption system
- c) Controls used in Refrigeration and Air Conditioning
- d) Vortex Tube Refrigeration
- e) Steam jet refrigeration
- f) Liquefaction of gases
