

(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)**

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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
