

(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) Explain difference between vapour compression refrigeration system and vapour absorption refrigeration system. 04
- b) Explain the need of aircraft refrigeration. Draw reduced ambient air refrigeration cycle with neat schematic and T-S diagram. 08
- c) Define the term 'by pass factor' used for heating and cooling coil. 04
- d) What is the difference between heat pump and refrigerator. Derive the relationship for COP between refrigerator and heat pump 04

Q.2 a) Explain the working of simple vapour compression cycle with schematic and P-h and T-s diagrams. 08

b) 100 kW power is used for refrigeration system working on bootstrap air refrigeration cycle. 12

Required data are given below:

Ambient air pressure = 1 bar

Ambient air temperature = 288 K

Compressor delivery pressure = 3.5 bar

Cabin pressure = 1 bar

Maximum pressure = 5.6 bar

Heat exchanger effectiveness for both heat exchanger = 0.85

Efficiency of main and auxiliary compressors is 0.83 and 0.75 resp.

Turbine efficiency = 0.77

Cabin is maintained at 28°C and 1 bar

Determine

- i. Refrigeration capacity in TR
- ii. COP
- iii. Determine the percentage of turbine power used by auxiliary compressor

*Assume No ramming,*

Q.3 a) Explain the ozone depletion and global warming issues. Discuss desirable properties of good refrigerant and designation of refrigerant with example. 08

b) A food storage locker has a capacity of 12 TR and operates between the evaporation temperature of -8 °C and condensation temperature of 30 °C. The refrigerant R-12 is sub-cooled by 5 °C before throttling and the vapour is superheated by 2°C before leaving the evaporator. Assuming a twin cylinder single acting compressor running at 1000 RPM with L:D 12

(P.T.O)

Q.P. Code :13783

ratio of 1.5.. Calculate:

- i. COP of system
- ii. Specific power required
- iii. Diameter
- iv. Stroke of compressor having volumetric efficiency of 0.945

Draw P-h and T-s diagram.

- Q.4 a) What are the types of expansion valves? Explain the working of thermostatic expansion valve. 06
- b) The design conditions for an air conditioned hall are: 14  
 Inside condition 24°C, 60% RH DBT  
 Outside 38°C DBT, 28°C WBT  
 Sensible heat gain = 45 kW  
 Latent heat gain = 11.25 kW  
 Infiltrated air = 1200 m<sup>3</sup>/h  
 Coil ADP = 10°C  
 60% of total air is re-circulated and mixed with conditioned air after cooling coil. Find
- i. Condition of air entering hall
  - ii. Refrigeration load.
- Q.5 a) What is aspect ratio? Discuss the different methods of duct design. 08
- b) Explain Li-Br Water vapour absorption system with neat sketch. 06
- c) Explain briefly types of condensers. 06
- Q.6 Write short notes on any **five** of the following: 20
- a) Cooling tower performance and selection
  - b) Air conditioning and human comfort
  - c) Deep sea water air conditioning
  - d) Dairy process plant
  - e) Types of Psychrometric processes
  - f) Steam jet refrigeration
  - g) Controls used in Refrigeration and Air Conditioning

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