

Total No. of Questions :10]

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SEAT No. :

[Total No. of Pages :4

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B.E. (Mechanical)

REFRIGERATION & AIR CONDITIONING

(2015 Pattern) (Semester-I) (EndSem.) (302049)

Time :2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Assume suitable data if necessary and mention it clearly.
- 3) Use of steam table and psychrometric chart is allowed.

Q1) a) Explain automotive air conditioning with its components and their function in brief. [6]

b) Write any four eco-friendly refrigerants with their chemical formula and designation. [4]

OR

Q2) a) Explain aqua ammonia vapour absorption refrigeration system with schematic diagram. [4]

b) An ideal vapour compression refrigerator uses methyl chloride (R40) as a refrigerant and operates between temperature limits of -10°C and 45°C. At entry to the compressor, the refrigerant is dry saturated and after compression it acquires a temperature of 60°C. There is no under-cooling. Find the COP of the refrigerator. Take  $C_p = 1.09 \text{ kJ/kg.K}$ . Draw p-h diagram of the cycle.

The relevant properties of methyl chloride (R40) are as follows: [6]

Sat. Temp	$h_f$	$h_g$	$s_f$	$s_g$
°C	kJ/kg	kJ/kg	kJ/kg.K	kJ/kg.K
-10	45.38	460.76	0.183	1.762
45	132.98	483.6	0.485	1.587

P.T.O.

Q3) a) Compare vapour compression refrigeration system and vapour absorption system on any four criterion. [4]

b) Calculate percentage change in COP of the system when generator temp changes from 150°C to 200°C; refrigeration temp decreases from -20°C to -40°C. Condensation takes place at 30°C. [6]

OR

Q4) a) Draw schematic and p-h diagram cascade refrigeration system and explain its working. [6]

b) Why is flash gas intercooling is used in multistage compression. Explain its advantages. [4]

Q5) a) Define specific humidity, relative humidity and dry-pass factor. [6]

b) The pressure of the air entering and leaving the adiabatic saturator is 1 bar. The air enters at 30°C and leaves as saturated air at 20°C. the specific humidity of entering steam of air is 0.0107 kg/kg of dry air. Calculate the specific humidity, relative humidity of exit the air vapour mixture. [10]

OR

Q6) a) Write a note on indoor air quality requirement. [4]

b) What is infiltration? [2]

c) The atmospheric air at 25°C DBT and 12°C WBT is flowing at a rate of 100 m<sup>3</sup>/min through a duct. The dry saturated steam at 100°C is injected into the air stream at a rate of 72kg/h. Calculate the specific humidity, DBT, WBT, relative humidity and enthalpy of air leaving the duct. Show the process on psychrometric chart. [10]

Q7) a) Explain with neat sketch winter air conditioning system. [6]

b) Explain with neat sketch capillary tube. [6]

c) Explain with neat sketch working of thermostat. [6]

OR

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- Q8) a) Explain variable air volume system. State any two advantages over constant air volume system. [6]
- b) Explain with neat sketch water cooled condenser. [6]
- c) Draw p-v diagram of single acting single stage reciprocating compressor and explain its working in brief. [6]
- Q9) a) Explain any two duct shapes with sketches and list any four duct materials. [6]
- b) A rectangular duct, 800mm  $\times$  550mm size carries 5m<sup>3</sup>/s of air having density 1.15kg/m<sup>3</sup>. Determine equivalent diameter of circular duct if i) Air flow is same, ii) Air velocity is same. Further find pressure loss per 100 m for  $f=0.001$ . Also calculate total pressure required at inlet to the duct to maintain the same flow, and air power required. [10]
- OR
- Q10) a) Explain any two types of filters used in air conditioning system. [4]
- b) Explain any two types of supply air outlets with suitable diagrams. [6]
- Grille outlets
  - Ceiling diffuser outlets
  - Slot diffuser outlets
- c) Explain equal friction method of duct design. [6]

