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Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Automobile Engineering/Mechanical Engineering

AU 010 704/ME 010 704—REFRIGERATION AND AIR-CONDITIONING (AU, ME)

(New Scheme—2010 Admission onwards—Regular/Supplementary)

Time : Three Hours Maximum : 100 Marks

Use of RAC Data Book, Psychrometric charts and Steam tables are permitted.

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Represent COP of a Carnot refrigerator in terms of compression ratio and ratio of specific heats.
2. Discuss the desirable characteristics of a fluid to be used as a refrigerant.
3. Discuss the effect of subcooling on COP.
4. Explain the terms :
   (a) Thermodynamic wet bulb temperature.
   (b) Dew point temperature.
   (c) Absolute humidity.
5. How capillary tube works in a refrigeration system ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Write the working of a steam jet refrigeration system with a neat diagram.
7. With the help of a neat diagram, discuss the working of Bell-Coleman refrigerator.
8. Discuss the effect of wet, dry and superheated compression on COP of a vapour compression refrigeration system. Draw the p-h diagram for the process.
9. Discuss briefly about any two expansion devices used in refrigeration systems.
10. Describe thermal analysis of human body.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. A reversed Carnot cycle working as a heat pump is delivering 40,000 kJ/min to heat conditioned space and maintaining it at 25° C. when the outside atmospheric air is 15° C. Find :

    (a) Heat pumped into the conditioned space from atmospheric air. (4 marks)

    (b) Power required to operate the cycle. (3 marks)

    (c) If the same conditioned space is heated by electric coils determine the consumption of electricity. (3 marks)

    (d) COP. (2 marks)

Or

12. In a Bell-Coleman refrigeration plant, the air is drawn from the cold chamber at 1 bar and 10° C. and compressed to 5 bar. The same is cooled to 25° C. in the cooler before expanding in expansion cylinder to cold chamber pressure of 1bar :

    (a) Determine the theoretical COP of the plant and the theoretical net refrigeration effect/kg. of air. The compression and expansion is assumed to be isentropic. (6 marks)

    (b) If the compression and expansion laws followed are $PV^{1.35} = C$ and $PV^{1.3} = C$ respectively, how will the result be modified. (6 marks)

13. A two stage refrigeration system with flash intercooling works between a condenser temperature of 40° C. and an evaporator temperature of – 15° C. Obtain COP and capacity of the system if the mass flow rate through the evaporator is 0.2 kg/s. The intermediate pressure is 4.2 bar. Compare the COP and capacity with a corresponding single stage system operating between the above temperature limits R-12 is used as the refrigerant.

Or

14. A R-12 refrigerating machine operates at – 10° C. evaporator and 35° C. condenser temperature. Assume simple saturated cycle. Determine the volume of suction vapour and power consumption per ton of refrigeration and COP of the cycle.

15. Explain the working of LiBr-H_2O absorption refrigeration system with the help of a neat diagram.

Or

16. Explain :

    (i) Magnetic refrigeration. (6 marks)

    (ii) Thermoelectric refrigeration. (6 marks)

17. With the help of a neat diagram, explain the working of thermostatic expansion values.

Or

18. How condensers are classified ? Explain each of them with the help of diagrams.

19. (a) Define (a) relative humidity ; (b) WBT. (4 marks)

(b) Moist air exists at 24° C. DBT and 18° C. WBT find other properties of air at 101.325 kPa by psychrometric chart. Also find the properties by using equations/tables for a pressure of 80 kPa.

(8 marks)

Or

20. (a) Air at 25° C., 70 % humidity and 1 bar is compressed to 2 bar and cooled back to 25° C. find water condensation per kg. of air.

(b) Air at 1 bar, 25° C., 50 % RH is to be heated to 50° C. as it flows through an air heater. Sketch the process on the psychrometric chart labelling initial and final points. How much heat is transferred in the process if the flow rate of air is 2.5 kg./s.

[5 × 12 = 60 marks]