April 2024

Time – Three hours
(Maximum Marks: 100)

[N.B.   1.   Answer all questions under Part-A. Each question carries 3 marks.

2.   Answer all the questions either (A) or (B) in Part-B. Each question carries 14 marks.

3.   Use of Refrigeration and Steam Tables are permitted.]

PART – A

1.   Define Stefan- Boltzmann law of radiation.

2.   Differentiate natural draught and forced draught cooling towers.

3.   Define COP.

4.   What are the advantages of solar absorption system?

5.   What is capillary tube?

6.   What are the properties of sulphur dioxide refrigerant?

7.   What is degree of saturation?

8.   What is sensible heating and cooling process?

9.   What are the types of insulating materials?

10.   What are the various room heat gain and loss components?

[Turn over.....

PART – B

11. (a) (i) Discuss dry ice refrigeration system. (6)

(ii) A reversed Carnot cycle working as heat pump is delivering 10,000 kcal/min to heat the conditioned space and maintain it at 25°C, when the outside atmospheric air temperature is 15°C.

(1) Find the heat pumped into the conditioned space from atmospheric air and the kW required for operating the cycle.

(2) If the same conditioned space is heated by electric heaters, determine the consumption of electricity in terms of kW consumed. (8)

(Or)

(b) (i) Explain the construction and working principle of rotating vane type compressor with a neat sketch. (7)

(ii) Explain the construction and working principle of shell and tube condenser with neat sketch. (7)

12. (a) The temperature limits of an ammonia refrigerating system are 25°C and -10°C. If the gas is dry at the end of compression, find the COP of the cycle assuming no under cooling of the liquid ammonia.

(Or)

(b) Explain the construction and working of Lithium Bromide water absorption refrigeration system. State its applications.

13. (a) Explain the construction and working of thermostatic expansion valve with a neat sketch.

(Or)

(b) Explain the construction and working of water cooler with neat sketch.

14. (a) (i) Explain the cooling and dehumidification process on psychrometric chart. (6)

(ii) Explain the construction and working of spray type air washer humidifier with a neat sketch. (8)

(Or)

(b) A conference hall of 60 seating capacity is to be air conditioned. The outdoor air conditions are 32°C DBT and 22°C WBT and required comfort conditions are 22°C DBT and 55% RH. The quantity of air supplied is 0.5m^3/min/participant. The comfort conditions are achieved first by dehumidifying the air and then cooling by the cooling coil. Find the following.

(i) DBT of the air leaving the dehumidifier.
(ii) Capacity of the dehumidifier.
(iii) Capacity of the cooling coil in TR.
(iv) Surface temperature of the cooling coil if the BPF of coil is 0.3.

15. (a) Explain the construction and working principle a window type air-conditioner with a neat sketch.

(Or)

(b) A conference room for seating 100 persons is to be maintained at 20°C DBT and 65% RH. The outdoor conditions are 35°C and 25°C WBT. The various loads in the auditorium are as follows.
Sensible heat and latent heat loads per person, 90W and 40W respectively; lights and fans 20 kW; the air infiltration is 20 m^3/min and fresh air supply is 100 m^3/min, two third of recirculated room air and one third of fresh air are mixed before entering the cooling coils. The by-pass factor of the coils is 0.1. Determine SHF, apparatus dew point temperature and GTH load.