2019

B.Tech Even Semester (CBCS) Exam., May—2019

AGRICULTURAL ENGINEERING

(6th Semester)

Course No. : AE-CC–31

(Refrigeration and Air Conditioning)

Full Marks : 50
Pass Marks : 15

Time : 2 hours

Note : 1. Answer *any* **five** questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the margin indicate full marks for the questions.

1. Air of 1000 m^3/min recirculated at 45 °C dry bulb temperature and 20 °C dew-point temperature is to be mixed with 700 m^3/min

of fresh air at 65 °C dew-point temperature and 65% relative humidity. Determine the following properties of the mixture using psychrometric chart :

(a) dew-point temperature
(b) enthalpy
(c) specific volume
(d) humidity ratio
(e) wet bulb temperature
(f) dry bulb temperature
(g) relative humidity

Support your answer with a representative figure of the processes. 10

2. With the help of a neat figure, describe the vapour compression refrigeration system. 10

3. With the help of a neat figure, describe the vapour absorption refrigeration system. 10

4. A building has a U-value of 0·5 W/m^2.K and a total exposed surface area of 384 m^2. The building is subjected to an external load (only sensible) of 2 kW and an internal load of 1·2 kW (sensible). If the required internal temperature is 25 °C, state whether a cooling system is required or a heating system is required when the external temperature is 3 °C. How the results will change, if the U-value of the building is reduced to 0·36 W/m.K? 10

5. Lettuce was vacuum-cooled and then loaded into a refrigerated truck for shipment to a market. The trip will last 48 h. Calculate the total amount of heat removed and the peak refrigeration load (maximum heat removal rate) if the amount of lettuce loaded is 3000 kg, the temperature in the truck is 2 °C, the temperature of lettuce when loaded is 5 °C and will drop to 2 °C in 2 h, the heat capacity of lettuce is 4·02 kJ/kg °C, the area of the walls of the truck is 80 m^2, the overall heat transfer coefficient for the walls is 0·3 W/m^2 °C, the outside air temperature is 20 °C and the heat of respiration of lettuce in the temperature range of 2 °C to 5 °C is 35 10^{3} W/kg. 10

6. *(a)* Discuss the advantages and disadvantages of steam jet refrigeration system. 5

(b) Describe the desirable properties of a refrigerant. 5

7. Explain briefly the different types of air conditioning system. 10

8. Write short notes on the following : 2×5=10

(a) Temperature-entropy diagram

(b) Pressure-volume diagram

(c) Vortex tube refrigeration systems

(d) Importance of psychrometric chart

(e) Coefficient of performance

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