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B.Tech Even Semester (CBCS) Exam., May—2018

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. *(a)* Define all the important psychometric properties. 4

(b) Briefly explain about the uses of comfort chart. 2

(c) An airstream *A* having temperature 20 °C, absolute humidity of 0·0152 kg of water per kg of dry air and flow rate of 10 kg dry air per hour, respectively is mixed with stream *B* having temperature 40 °C, absolute humidity of 0·0256 kg of water per kg of dry air and flow rate of 100 kg dry air per hour, respectively. If the heat capacity values of air and water vapour are 1·005 and 1·884 kJ/kg^{1} °C^{1}, respectively and latent heat of vaporization of water at 0 °C is 2500 kJ/kg^{1}, then find out the absolute humidity and temperature of the resultant stream. 4

2. *(a)* Elaborately explain about all the thermodynamic properties of refrigerants. 6

(b) Define the purpose of the compressor in refrigeration systems. 2

(c) Discuss the advantages and disadvantages of vapour compression refrigeration system over air refrigeration system. 2

3. *(a)* Define primary and secondary refrigerants. 2

(b) A cold storage plant is required to store 20 tonnes of fish. The fish is supplied at a temperature of 30 °C. The specific heat of fish above freezing point is 2·93 kJ/kg K. The specific heat of fish below freezing point is 1·26 kJ/kg K. The fish is stored in cold storage which is maintained at –8 °C. The freezing point of fish is –4 °C. The latent heat of fish is 235 kJ/kg. If the plant requires 75 kW to drive it, find the capacity of plant and time taken to achieve cooling. The actual COP of the plant is 0·3 of the Carnot COP. 8

4. (a) Elaborately explain about the practical difficulties with Carnot refrigeration system. 5

(b) A cold room maintains a temperature of –15 °C. The ambient air temperature is 30 °C. If the heat leakes into the room at the continuous rate of 1·5 kW, what would be the least power required maintaining the temperature of the cold room, assuming that the refrigeration system is a reverse Carnot heat engine? 5

5. (a) Define the following : 3+3=6

(i) Vortex tube refrigeration systems

(ii) Absorption refrigeration systems

(b) Discuss about the processes involved in vapour compression refrigeration system. 4

6. (a) With the help of a neat and labelled diagram, explain the working of steam jet refrigeration system. 5

(b) Write down the advantages and disadvantages of steam jet refrigeration system. 5

7. (a) Explain the working of vortex tube refrigeration system. 5

(b) Find out the fall in the temperature of water when 2·5 kg of water evaporates from a 100 kg of source, assume latent heat of water is 2395 kJ. 5

8. (a) Explain the advantages and disadvantages of air-water system. 3

(b) A building has a U-value of 0·6 W/m^2K and a total exposed surface area of 400 m^2. The building is subjected to an external load (only sensible) of 2·5 kW and an internal load of 1·4 kW (sensible). If the required internal temperature is 28 °C, state whether a cooling system is required or a heating system is required when the external temperature is 2 °C. Also define that how the results will change, if the U-value of the building is reduced to 0·40 W/m^{2}K. 7

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