KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Food Technology) 2021 Admission
IV Semester Final Examination – August 2023

Pafe.2222 **Food Refrigeration and Cold Chain (2+1)** **Marks: 50**
Time: 2 hours

I **Fill in the blanks** **(10x1=10)**

1. One Ton of Refrigeration is equal to ..... kJ/min.
2. The ideal gas refrigeration cycle is similar to ..... cycle.
3. When water is used as a refrigerant it is designated as R.....
4. The effective surface temperature of a cooling coil in an air-conditioning system is known as .....
5. The most economical aspect ratio for a rectangular duct is .....

State True or False

6. A desirable property of a refrigerant is low boiling point.
7. In general, COP of a practical vapour compression system as compared to that of a vapour absorption system is less.
8. Superheating the suction vapour of compressor, with useful cooling increases refrigerating effect per unit mass of refrigerant.
9. In a lithium bromide-water vapour absorption refrigeration system the refrigerant is lithium bromide.
10. An air washer can be used for cooling and humidification only.

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. What do you mean by the Clausius Statement?
2. What is Peltier effect?
3. State the advantages of a cold storage.
4. State different methods of duct sizing during design of air distribution systems.
5. Define volumetric efficiency of a reciprocating compressor.
6. What are the outputs of cooling load calculation in a cooling and dehumidification system?
7. Define cold chain.

III **Answer ANY FIVE of the following** **(5x4=20)**

1. A machine works on reversed Carnot cycle between -10 °C to 27 °C. Find its efficiency or COP (as applicable) when working as a a) heat engine; b) refrigerator; c) heat pump
2. Briefly explain why throttling is preferred over isentropic expansion in a vapour compression refrigeration system.
3. Show that the COP of a two-stage cascade refrigeration system is given by $COP = (COP_1 \times COP_2) / (1 + COP_1 + COP_2)$, where COP_1 and COP_2 are COPs of low pressure and high pressure cycle, respectively.
4. Compare Vapour Compression Refrigeration System (VCRS) with Vapour Absorption Refrigeration System (VARS).
5. A wall is made of bricks of 250 mm thickness and cement of 10 mm thickness. The indoor and outdoor temperatures are 23 °C and 43 °C. Area of the wall normal to the direction of heat flow is 10 m x 5 m. The convective heat transfer coefficients inside and outside are 41.67 $W/m^2°C$ and 75 $W/m^2°C$, respectively. Thermal conductivity of brick = 0.767 W/m°C and that for cement = 0.433 W/m°C. Determine the heat flow rate through the wall.

6. Consider a room of dimension 5 m x 4 m x 3 m. The cooling loads are calculated as below:
   Sensible heat load:
   Solar heat gain due to conduction and convection = 3913 W;
   Solar heat gain through glass = 277 W;
   Occupancy = 6;
   Sensible heat load per person = 74 W;
   Number of lights = 5;
   Lighting load = 40 W/light;
   Ventilation load (sensible) = 232 W.
   Latent heat load:
   Latent heat load per person = 62 W;
   Ventilation load (latent) = 185 W.
   Calculate the Sensible Heat Factor and capacity of the air-conditioner in Tons of Refrigeration.
7. Briefly discuss about portable icemakers.

IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. Describe and explain the working principle of a thermostatic expansion valve.
2. Briefly discuss about transport refrigeration in the cold chain concept.

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