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M.Tech. (Food Technology) (2018 Batch) (Sem.–1)

ADVANCES IN FOOD ENGINEERING

Subject Code : MTFT-511-18

M.Code : 75598

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. a) Describe the physical and mechanical properties of the food materials and their significance in equipment design. (7)

   b) Write a note on the current challenges being faced by food industry. (5)

2. a) Define D, F and Z values. Discuss their significance in the preservation of food. (6)

   b) A fluid food product has a viscosity of 5.8 cP and a density of 1012 kg/m^3. It is to be pasteurized in a continuous system that involves heating at 82.8°C holding in a 3.75 cm diameter pipe and cooling. A sterilizing value of 12 ($D_{82.8°C}$ = 0.0058 minutes) is desired. Calculate the length of holding tube for a flow rate of 21 litre/minute. (6)

3. a) Derive an expression for Bernoulli's equation for a non-compressible fluid. (7)

   b) A capillary tube of diameter 2.5mm and length 120mm is used for measuring the viscosity of the liquid. The difference of pressure between the two ends of the tube is 0.6867 N/cm^2 and the viscosity of the liquid is 0.25poise. Find the rate of flow of liquid through the tube. (5)

4. a) Give a detailed classification of pumps. Discuss important characteristics of centrifugal pumps and their application in food industry. (7)

   b) Discuss power law fluids with examples also write the equations depicting their behaviour. (5)

5. a) Compare tubular and plate heat exchangers. Discuss briefly the design of plate heat exchanger. (7)

b) It is proposed to build a cold store having an outer wall of concrete (100 mm thick) and an inner wall of wood (10 mm thick), with the space in between (100 mm) filled with polyurethane foam. If the inner wall temperature is 5°C and the outer wall is maintained at the ambient air temperature of 20°C, calculate the rate of heat penetration. (5)

6. a) Distinguish between : (6)

i) Steady state and unsteady state heat transfer

ii) Free and forced convection

b) Oil (mass flow rate 1.5 kg/s C_p = 2 kJ/kgK) is cooled in a single pass shell and tube heat exchanger from 65 to 42°C. Water (mass flow rate 1 kg/s, C_p = 4.2 kJ/kgK) has an inlet temperature of 28°C. If the overall heat transfer coefficient is 700 W/m^2K, calculate heat transfer area for a counter flow arrangement using $\in$ – NTU method. (6)

7. a) How the freezing point curve of a solution differs from that of pure water. Describe the freezing point curve of a solution. (6)

b) By using Plank's equation calculate the time to freeze beef carcass having average dimensions 1.50 m × 0.6 m x 0.07 m; 75% water, thermal conductivity 1.04 W/mK, specific heat 3.5 kJ/kg K, density 1060 kg/m^3. The carcass is initially freezing at temperature of - 2.8°C and is being frozen in an air blast freezer (having convective heat transfer coefficient as 22 W/m2K) with air at –30°C. The latent heat of fusion of water to ice is 334 kJ/kg. For slab P=l/2 and R=l/8. (6)

8. a) Differentiate between freeze drying and conventional drying. Write a note on the lyophilization of foods. (6)

b) Differentiate between reverse osmosis and ultra-filtration. Write the advantages and limitations of different types of membrane for RO and UF. (6)

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.