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Total No. of Questions : 09

B.Tech. (Food Technology) (Sem.–4)

FOOD ENGINEERING

Subject Code : BTFT224-19

M.Code : 79978

Date of Examination : 07-07-22

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) Define F value in thermal processing.

b) Define Z value and derive relation between D_{T1} & D_{T2} value at T1 and T2 temperature.

c) Describe the effect of temperature on thermal process time.

d) Differentiate the Newtonian and Non-Newtonian fluid with examples.

e) Describe pitot tube and its application.

f) Define freezing point and describe freezing curve.

g) Enlist various types of pumps and describe at least one.

h) Describe commercial sterilization.

i) Define Reynolds Number (N_{re}) and describe how flow behaviour changes with the Reynolds Number (N_{re}).

j) Determine the *z* value for a microorganism that has the following decimal reduction times: D_{110} = 6 minutes, D_{116} = 1.5 minutes, D_{121} = 0.35 minutes, and D_{127} = 0.09 minutes.

SECTION-B

2. Orange juice is being concentrated in a natural-circulation single-effect evaporator. At steady-state conditions, dilute juice is the feed introduced at a rate of 0.70 kg/s. The concentration of the dilute juice is 12% total solids. The juice is concentrated to 70 % total solids. The specific heats of dilute orange juice and concentrate are 4.0 and 2.4 kJ/(kg °C), respectively. The steam pressure is measured to be 304.42 kPa. The inlet feed temperature is 43.3°C. The product inside the evaporator boils at 62.2°C. Calculate the product, vapor, and steam flow rate.

   From the steam table:

   Temperature of steam at 304.42 kPa = 134°C

   Enthalpy for saturated vapor H_{vs} (at T_s = 134°C) = 2725.9 kJ/kg

   Enthalpy for saturated liquid H_{cs} (at T_s 134°C) = 563.41 kJ/kg

   Enthalpy for saturated vapor H_{vl} (at T_1 = 62.2°C) = 2613.4 kJ/k

   ASSUMPTIONS :

   a. Assume negligible boiling-point elevation.

   b. Assume 100% steam efficiency

   c. No heat is lost to surrounding.

3. A centrifugal pump is operating at 1800 rpm against 30 m head with a flow rate of 1500L/min. If the pump speed is doubled, calculate the new flow rate and developed head.

4. Explain the working principle of Venturimeter with clean diagram.

5. 10 log cycle reduction of B subtilis is to be achieved in a sterilization process of milk. The values of $D_{121.1}$ and $Z_{21.1}$ for this spore are 25 second and 7°C respectively. Calculate the value of D_{130} and sterilization 130ºC.

6. Describe the Vapour Compression Refrigeration System (VCRS) and explain the role of each component in VCRS.

SECTION-C

7. Describe lethality. And estimate the spoilage probability of a 50-minute process at 113°C, when D_{121} = 4 minutes and Z = 8°C and the initial microbial population is 10^4 per container.

8. Partially frozen ice cream is being placed in a package before completion of the freezing process. The package has dimensions of 8 cm by 10 cm by 20 cm and is placed in air blast freezing with convective heat coefficient of 50 W / (m^2 K) for freezing. The product temperature is -5°C when placed in the package, and the air temperature is -25°C. The product density is 700 kg/m^3, the thermal conductivity (frozen) is 1.2 W / (m K), and the specific heat of the frozen product is 1.9 kJ / (kg K). If the latent heat to be removed during blast freezing is 100 kJ / kg, estimate the freezing time.

9. A refrigeration machine is to deliver a refrigeration capacity of 80 kW at -30°C. The refrigerant is R-134a. The condenser is air cooled. Condensation temperature is assumed to be 35°C. Complete condensation with no supercooling is assumed. To avoid wet compression, 5ºC superheat is allowed at the exit from the evaporator. Calculate the theoretical compressor power, the heat rejected at the condenser and the coefficient of performance of the machine.

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.