Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI- EXAMINATION – SUMMER 2016

Subject Code:161403 **Date:09/05/2016**

Subject Name:Food Engineering Operations - II

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Raw whole milk at 8°C is to be pasteurized at 72°C in Plate Heat Exchanger at the rate of 3500 liter/hour and then cooled to 4.5°C. The hot water is supplied at 5000 liter/hour at 85°C. Chilled water inlet temperature is 2°C and outlet temperature is 4.5°C. Each heat exchanger plate has available area of 0.79 m². The overall Heat Transfer coefficients are calculated as 2890 W/m²K in the heating section; 2750 W/m²K in the cooling section; 2700 W/m²K in regeneration section. 70% of the heat exchange is required to take place in the regeneration section. Calculate the number of plates requires in heating, cooling and regeneration section. **07**

Assume that the density of milk is 1030 kg/m³. The density of water is 958 kg/m³ at 85°C and 1000 kg/m³ at 20°C. The specific heat of water is constant as 4.2 kJ/kg K and the specific heat of milk is 3.9 kJ/kg K.

(b) A feed of 50 mole% hexane and 50 mole% hexane is fed into a pipe through a pressure reducing valve and then into a flash disengaging chamber. The vapor and liquid leaving the chamber are assumed to be in equilibrium. If the fraction of the feed converted to vapor is 0.6 find the composition of the top and the bottom product. **05**

The following table gives the equilibrium data for this system:

Mole fractions of hexane in liquid, x	1	0.69	0.4	0.192	0.045	0
Mole fractions of hexane in vapor, y	1	0.932	0.78	0.538	0.1775	0

(c) Write in brief about binary distillation. **02**

Q.2 **(a)** Explain HTST Pasteurization with diagram. What are the advantages of HTST pasteurization? **07**

(b) What do you mean by fouling of materials on heat exchanger? Explain the parameters which affect the fouling of materials. **07**

OR

(b) Explain the batch sterilization process in details. State the advantages and limitations for batch sterilization. **07**

Q.3 **(a)** Explain flash distillation and derive a material balance equation of flash distillation in terms of f. Derive an operating line equation for stripping section for distillation column. **07**

(b) What is leaching? Draw and explain Bollman extraction in detail. **07**

OR

Q.3 **(a)** (1) Write a Short note on Mixer settlers for extraction. **04**

(2) A solution of picric acid in benzene contains 30 gm of picric acid per liter. Calculate the quantity of water with which 1 liter of this solution must be shaken at 18°C in order to reduce the picric acid concentration to 4 g/lit in the benzene phase. Molecular weight of picric acid is 229 and the distribution co-efficient K is given as 0.548. **03**

(b) Explain principle of cake filtration. Write a short note on filter press. **07**

Q.4 **(a)** (1) Write in brief about centrifugal decanter. **04**

(2) Write a short note on Schiebel column **03**

(b) (1) Write a short note on Invariant crystals **04**

(2) Write a short note on scrapped surface crystallizer. **03**

OR

Q.4 **(a)** Explain gravity separation in details. State the Stoke's law for sedimentation. **07**

(b) Find the velocity at which the fat globules will begin to move upward, towards the surface in case of centrifugal separation. If the diameter of the fat globule is 3 μm; density difference of milk and fat globules $\Delta\rho$ = 48 kg/m³, absolute viscosity $\mu = 1.42 \times 10^{-3}$ kg/m.s; R = 0.2 m and n = 5400 rpm. **03**

(c) Explain the factors affecting the freezing time. **04**

Q.5 **(a)** Define homogenization. What are main components of homogenizer? Explain homogenizer pump in details with neat diagram. **07**

(b) Explain the types of sterilization plant. Write the advantage and limitations of indirect heating systems. **07**

OR

Q.5 **(a)** (1) Write a short note on clarifying filters. **04**

(2) Write in brief about filter aids. **03**

(b) Explain mechanism of sedimentation in detail with figure. **07**

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