

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-VI • EXAMINATION – SUMMER • 2014**

**Subject Code: 161403****Date: 23-05-2014****Subject Name: Food Engineering Operations-II****Time: 10:30 am - 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) (1) Mention two distinct purposes of milk pasteurization **01**  
 (2) What do you mean by regeneration efficiency of regenerator? If cold milk enters the regenerator at 4 °C, after regeneration comes out at 65 °C and final pasteurization temperature is 72 °C, then calculate the regeneration efficiency. **01**  
 (3) What do you mean by fouling of heat exchanger? What are the effects of fouling on the performance of a Plate Heat Exchanger (PHE)? Explain two methods of de-scaling of heat exchanger. **05**
- (b) (1) With help of labelled diagram, describe the construction, principle and working of a single stem flow diversion device (FDD) used in a HTST pasteurizer clearly showing forward flow and divert flow. **04**  
 (2) The F value at 121.1 °C equivalent to 99.9999% inactivation of a strain of *C. botulinum* is 1.9 minutes. Calculate **03**  
 (i) the D<sub>0</sub> value of this organism.  
 (ii) F<sub>0</sub> based on the 12D concept using the D<sub>0</sub> value of *C. botulinum* and a most likely spore load in the product of 1000.
- Q.2** (a) Define homogenization of milk. What are the factors that contribute to the enhanced stability of homogenized milk? Define F-value. **07**  
 Determine the rising velocity (in mm/h) of the fat globule of diameter 3 μm at a radial position of 0.16 m in a centrifuge, rotating at a speed of 5000 rpm. The density of skim milk and fat is 1028 and 980 kg/m<sup>3</sup>, respectively and absolute viscosity is 1.42 centipoise.
- (b) Explain flash distillation with figure. And derive Rayleigh equation. **07**
- OR**
- (b) Write a short note on relative volatility and derive relative volatility equation. **07**
- Q.3** (a) Define distribution coefficient for extraction. **07**  
 Penicillin F is recovered from a dilute aqueous fermentation broth by extraction with amyl acetate using 6 volumes of solvent per 100 volumes of the aqueous phase. At pH = 3.2 the distribution coefficient k is 80.  
 (i) What fraction of the Penicillin would be recovered in a single ideal stage?  
 (ii) What would be the recovery with two stages extraction using fresh solvent in both stages?
- (b) Write a short note on Mixer settlers for extraction. **07**
- OR**
- Q.3** (a) Explain mechanism of crystallization in detail. Define Magma and Invariant Crystal. **07**  
 (b) A solution of picric acid in benzene contains 30 g of picric acid per litre. Calculate quantity of water with which 10 litre of this solution must be shaken at 18 °C in order to reduce picric acid concentration to 4 g per litre in benzene phase. Distribution Coefficient k is given as  $y/x = CR/CE = 1.8248$  where CR = concentration of picric acid in water (gmol/litre) and CE = concentration of picric acid in benzene (gmol/litre) **07**

- Q.4 (a)** With help of diagram, describe briefly different types of direct contact food freezing system. **07**
- (b)** What is the purpose of filter aid in filtration? Give example of it. Give application of ultra filtration? **07**

**OR**

- Q.4 (a)** What are clarifiers and thickeners? Write a short note on Batch sedimentation. **07**
- (b)** Explain extraction with example .Write a short note on rotocel extractor for leaching **07**

- Q.5 (a)** Write short notes on: **07**
- (1) Centrifugal decanter
  - (2) Scrapped surface crystallizer
- (b)** Write short notes on: **07**
- (1) Schiebel column
  - (2) Clarifying filters

**OR**

- Q.5 (a)** What is leaching? Write a short note on Bollman extractor. **07**
- (b)** Write a short note on relative volatility. **07**

A feed of 50 mole% hexane and 50 mole% octane 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.

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

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