

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI • EXAMINATION – WINTER 2013****Subject Code: 161403****Date: 02-12-2013****Subject Name: Food Engineering Operations-II****Time: 02:30 pm to 05:00 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)** Write a short note on flash distillation. Develop Rayleigh equation for simple batch distillation. **07**
- (b)** A continuous fractionating column is to be designed for separating 10,000 kg per hour of a liquid mixture containing 40 mole percent methanol and 60 mole percent water into an overhead product containing 97 mole percent methanol and a bottom product having 98 mole percent water. A mole reflux ratio of 3 is used. Calculate (i) moles of overhead product obtained per hour and (ii) number of ideal plates and location of the feed plate if the feed is at its bubble point. **07**

Equilibrium data:

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
y	0.417	0.579	0.669	0.729	0.78	0.825	0.871	0.915	0.959

Where x = mole fraction of methanol in liquidAnd y = mole fraction of methanol in vapor

- Q.2 (a)** What is relative volatility? Derive an equation for operating line of rectifying section for binary mixture in distillation column with neat sketch. **07**
- (b)** (1) Define the followings and represent it graphically **05**
- (i) D-value
 - (ii) Z-value
 - (iii) F-value
- (2) What is flooding and weeping? **02**
- OR**
- (b)** Explain extraction with example. Write a short note on Bollman extractor for leaching. **07**
- Q.3 (a)** What is leaching? **07**
- Fermentation broth enters a continuous mixer settler extraction unit at a flow rate of 100 lit/min. This contains 20 g/lit antibiotic and its pH has been adjusted to 3.0. Butyl acetate which is used as the extracting solvent enters the extractor at a flow rate of 10lit/min. At pH 3.0 the equilibrium relationship is given by $C_E = 40 C_R$, where C_R and C_E are the antibiotic concentrations in the raffinate and extract respectively and are expressed in g/lit. Calculate:
- a) The antibiotic concentration in the extract and the raffinate.
 - b) The fraction of antibiotic extracted.
- (b)** Describe in brief about cake filtration and its principle. **07**
- OR**
- Q.3 (a)** Define distribution co-efficient for extraction. Draw and explain equilateral triangular diagram for single stage liquid- liquid extraction process. **07**

	(b)	(i) Differentiate between pasteurization and Sterilization.	03
		(ii) How does homogenization of milk increases its stability? What are the effects of homogenization on properties of milk?	04
Q.4	(a)	Write a short note on batch sedimentation. What are clarifiers and thickeners?	07
	(b)	(i) Write the advantages and disadvantages of effect of homogenization on physical structure of milk.	04
		(ii) Write a short note on crystal growth.	03
		OR	
Q.4	(a)	(i) The F value at 121.1 °C equivalent to 99.99% inactivation of a strain of <i>C. Botulinum</i> is 1.4 minutes. Calculate the D0 value of this organism. Calculate F0 based on the 12D concept using the D0 value of <i>C. botulinum</i> and a most likely spore load in the product of 1000.	1.5
		(ii) In an experiment, the thermal death time (TDT) values for a microorganism were obtained as 1.5 minutes and 8.5 minutes at 121.1 °C and 112.5 °C, respectively. Determine the z-values (°C) of the microorganism.	1.5
		(iii) Write a short note on circulating magma vacuum crystallizer.	04
	(b)	List out different types of food freezing systems. Describe briefly with diagram : Plate freezing system.	07
Q.5	(a)	What is the purpose of filter aid in filtration? Write a short note on rotary vacuum filter.	07
	(b)	(i) With help of labeled 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.	05
		(ii) Classify acidic foods based on pH and their ranges with examples.	02
		OR	
Q.5	(a)	Describe in brief about Immersion freezing system with diagram.	07
	(b)	(i) Write a short note on mixer settler with neat sketch for extraction.	03
		(ii) Briefly explain the influence of freezing process on the thermal properties of food products.	04
