Seat No.: _____ Enrolment No._____

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 liquid

And 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 0C equivalent to 99.99% inactivation of a strain of *C. Botulinum* is 1.4 minutes. Calculate the D0 value of this organism. Calculate F0 based on the 12D concept using the D0 value of *C. botulinum* 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 0C and 112.5 0C, respectively. Determine the z-values (0C) 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**

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