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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2161403 **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) Write a short note on simple distillation. Develop the equation for operating line of rectifying section for binary mixture in distillation column with neat sketch **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:

Where x = mole fraction of methanol in liquid

And y = mole fraction of methanol in vapor

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

Q.2 (a) Advantages and applications of liquid-liquid extraction in food industry. Draw and explain equilateral triangular diagram for Single-stage liquid-liquid extraction process. **07**

(b) Define distribution coefficient for extraction. 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? **07**

OR

(b) Write a short note on relative volatility. What is the purpose of filter aid in filtration? Give example of it. **07**

Q.3 (a) A solution containing 10g/lit of a valuable protein and 1g/lit of a protein impurity is extracted in a stirred vessel using an organic solvent. Distribution co-efficient K=8 for the valuable proteins and 0.5 for the impurity. The initial volume is 500 lit and 400 lit of solvent are used for the extraction. What are the final concentration in the two phases and what fraction of each proteins is recovered in the solvent phase? **07**

(b) Write short notes on: **07**

(1) Crystal growth

(2) Circulating magma vacuum crystallizer

OR

Q.3 (a) What is crystallization? Discuss mechanism of crystallization process in detail. **07**

(b) Write a short note on Batch sedimentation. **07**

Q.4 (a) What are the advantages and difficulties with UHT processing? **07**

(b) What do you mean by Fouling of heat exchangers? Briefly explain the types of fouling deposits in heat exchanger used in milk pasteurizer and their effect on performance. **07**

How descaling of heat exchanger is done?

OR

Q.4	**(a)**	1. Differentiate between pasteurization and Sterilization. List out the advantages of Heat Exchangers over in-bottle processing in pasteurization.	**03**
		2. Define F value. For cans of pea puree, the F0 = 2.45 min at 121.1^{0}C and z = 10 ^{0}C. Neglecting heat-up time, determine the process time for adequate sterilization at110 ^{0}C at the centre of the can.	**04**
	(b)	1. With help of 1abelled 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.	**03**
		2. The F value at 121.1 0C equivalent to 99.9999% inactivation of a strain of C. botulinum is 1.9 minutes. Calculate (i) the D0 value of this organism. (ii)F0 based on the 12D concept using the D0 value of C. botulinum and a most likely spore load in the product of 1000.	**04**
Q.5	**(a)**	List out different types of food freezing systems. Describe briefly the fluidized bed IQF freezing system. Mention two most common refrigerants used for immersion freezing system.	**07**
	(b)	What do you mean by bactofugation and how is it done? Derive an expression for rising velocity of milk in a centrifugal disc bowl centrifuge indicating each variable with proper units.	**07**

OR

Q.5	**(a)**	1. Determine the rising velocity of the fat globule of diameter 3µm at a radial position of 0.2 m in a centrifuge, rotating at a speed of 5000 rpm. The density of skim milk and fat is 1028 and 980 kg/m3, respectively and absolute viscosity is 1.42 centipoise.	**03**
		2. Explain Magma and Invariant Crystal	**04**
	(b)	Write in brief about cake filtration and its principle.	**07**

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