Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2161403   **Date:14/05/2019**

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)**	Do as directed.	**03**
		i) State Stoke's law.	
		ii) Differentiate between Clarifier and Separator.	
		iii) Propeller agitators are effective in larger vessels. Justify the statement.	
	(b)	Fruit Puree is commercially sterilized at 110^0C in a can to reduce the number of heat resistant organism (D_{120} = 0.24 min., $Z=10^0C$) from an initial count of 1 million per can to a probability of survival of 1 in million. Determine the total processing time.	**04**
	(c)	Derive the operating line equation for rectifying and stripping section for continuous distillation with reflux.	**07**
Q.2	**(a)**	Differentiate between pasteurization plant and sterilization plant.	**03**
	(b)	Highlight on the working of continuous ice-cream freezer.	**04**
	(c)	Classify different pasteurization processes employed for liquid food products. Discuss HTST pasteurization process with flow line sketch.	**07**

OR

	(c)	Explain homogenization mechanism in liquid food products with a neat and well labeled sketch,	**07**
Q.3	**(a)**	Define Vacreation. State the objectives of vacreation.	**03**
	(b)	Calculate the rate of movement and the distance travelled by a fat globule in a centrifugal separator if the diameter of fat particle 6µm, radius of bowl 12 cm, rpm of bowl 7000, capacity of the separator 3000 lit./hr, volume of milk in bowl 3 lit.	**04**
	(c)	What are the different types of heat exchanger fouling? Suggest the effective means to reduce fouling.	**07**

OR

Q.3	**(a)**	Compare direct heating and indirect heating methods in thermal processing.	**03**
	(b)	Enlist the mechanical and product factors affecting freezing time of ice cream mix.	**04**
	(c)	A process was calculated such that the probability of spoilage from an organism with D_0 value of 0.5 min is 2 in 1,00,000 from an initial spore load of 1000. To verify this process, an inoculated pack is prepared. Calculate the level of inoculum of an organism having D_0 value of 1.4 min that must be used on 1000 cans such that a spoilage rate of 10 cans will be equivalent in lethality to the calculated process.	**07**

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Q.4 **(a)** Draw a feed line on the equilibrium diagram for various values of 'q', q<0, q=0, q=1, q>1 and 0<q<1. Also write the thermal condition of the feed in each case. **03**

(b) Describe the stepwise procedure for obtaining the number of theoretical plates required in a fractionating column. **04**

(c) What do you understand by flash distillation? **07**
A feed containing 50 mole % hexane and 50 mole % octane is fed to a pipe still through a pressure reducing valve and then into flash separator. The vapour and liquid leaving the separator are assumed to be in equilibrium. If 50 mole % of the feed is vaporised, find the composition of top and bottom products. The equilibrium data for the system is :

Mole fraction of hexane in liquid	1	0.69	0.4	0.192	0.045	0
Mole fraction of hexane in vapour	1	0.932	0.78	0.538	0.1775	0

OR

Q.4 **(a)** Write the overlapping principle for crystallization. **03**

(b) A salt solution weighing 10000 kg with 30% weight Na_2CO_3 is cooled to 293 K. The salt crystallizes as decahydrate. What will be the yield of $Na_2CO_3.10H_2O$ crystal if the solubility is 21.5 kg anhydrous Na_2CO_3/100 kg of total water? Do this for following cases: **04**
(i) Assume that no water is evaporated.
(ii) Assume that 3 % of total weight of the solution is lost by evaporation of water in cooling.

(c) What are the methods of generation of supersaturation? **07**
Describe a crystallization equipment where method of achieving supersaturation is by adiabatic evaporation and cooling alone.

Q.5 **(a)** Describe in brief with suitable diagram supercritical fluid extraction process. **03**

(b) Write important applications of the solid–liquid extraction in the food industry. What are the factors that influence the rate of leaching? **04**

(c) Derive the lever arm rule for a ternary system A (solvent), B (solute), and C (carrier). **07**

OR

Q.5 **(a)** What are the three main groups of filters? Write one important property of each. **03**

(b) Describe the centrifugal sedimentation process for the separation of solids from liquid with suitable diagram. **04**

(c) Discuss the principle of cake formation in filtration. Derive the equation for constant pressure filtration. **07**

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