Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER-VI • EXAMINATION – SUMMER 2015

Subject code: 161403 **Date: 08/5/2015**
Subject Name: Food Engineering Operations-II
Time: 10:30am to 1:00 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 the equation of Stokes law. Explain in detail about the factors which affect the stability of an emulsion? **04**

Q.1.(b) Define homogenisation. Write down the methods used to check the efficiency of homogenisation **03**

Q.1.(c) Derive an equation of recovery for two stage liquid-liquid extraction process. Draw and explain equilateral triangular diagram for single stage extraction process. **07**

Q .2.(a) Define D-value, Z-value, F_0 and F-value. 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 ^{0}C and 110 ^{0}C, respectively. Determine the Z-values (^{0}C) of the microorganism. **07**

Q.2.(b) What do you mean by fouling of heat exchanger? Enlist and explain the different methods of fouling deposit. List out any two methods of descaling/treatment of fouling. **07**

OR

Q.2.(b) Differentiate between Pasteurization and Sterilization (Any 3 points) .The F value at 121.1 ^{0}C equivalent to 99.9999% inactivation of a strain of *C. botulinum* is 3.6 minutes. **07**
(i) Calculate the D value of this organism.
(ii) Calculate F_0 based on the *12D* concept using the D value of *C.botulinum* and a most likely spore load in the product of 100.

Q.3.(a) Estimate the convective heat transfer coefficient in a food being frozen in an air-blast freezer. It took the product 20 minutes to freeze in the freezer. The product is in the shape of an infinite cylinder with a diameter of 2 cm. The properties of product are as follows: **07**
Thermal conductivity of frozen material = 1.8 W/(m^{0}C)
Density = 890 kg/m3 and the latent heat of fusion = 260 kJ/kg
Initial freezing point = - 1.9^{0}C
Initial temperature of product is = 25^{0}C
The air temperature is = -35^{0}C.
Geometric parameters P and R are ¼ and 1/16 respectively

Q.3. (b)	Enlist different types of food freezing systems. Describe briefly with diagram: i. Plate freezing system ii. Immersion freezing system	**07**
	OR	
Q.3. (a)	A food product with 80% moisture content is being frozen in a 6 cm-diameter can. The product density is 1000 kg/m3, the thermal conductivity is 1.0 W/(m K), and the initial freezing temperature is -2°C. After 10 h in the -15°C freezing medium, the product temperature is -10°C. Estimate the convective heat-transfer coefficient for the freezing medium. Assume the can has infinite height. [Take Latent heat of fusion of water = 333.3 kJ/kg and the geometric parameters as P= 1/4 and Q =1/16]	**07**
Q.3. (b)	Describe in detail the fluidized bed IQF freezing system with the help of a diagram. Mention two most common refrigerants used for immersion type of freezing.	**07**
Q.4. (a)	Write a short note on crystal growth and explain magma in detail.	**07**
Q.4. (b)	Define extraction. Fermentation broth enters a continuous mixer settler extraction unit at a flow rate of 100lit/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 CE = 40 CR, where CR and CE 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.	**07**
	OR	
Q.4. (a)	Write short notes on the followings. (1) Schiebel column (2) Filter aids (3) Rotocel extractor	**09**
Q.4.(b)	Describe in brief about cake filtration and its principle.	**05**
Q.5 .(a)	Derive Rectifying section operating line equation. Also explain total reflux ratio in detail.	**07**
Q.5 .(b)	Write uses of distillation in food industry. Derive Rayleigh's equation.	**07**
	OR	
Q.5 .(a)	Discuss in brief about batch sedimentation.	**07**
Q.5 (b)	Define the following terms (1)Entrainment (2)Foaming (3)flooding	**03**
Q.5.(c)	Write a short note on: plate and frame filter and explain with neat figure.	**04**

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