Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 141405 **Date: 31/12/2012**

Subject Name: Principles of Food Engineering (Institute Elective –I)

Time: 02.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the law of conservation of mass and energy as applied to food engineering operations and write expressions in terms of inflow, outflow and accumulation. Fresh tomato juice flowing through a pipeline @100 kg/minute is being salted by constantly adding saturated salt solution (26% w/w) to the pipe line. What would be the rate of addition of this salt solution so as to yield a tomato juice containing 2% w/w salt at the outlet of the pipe? **07**

(b) Enlist and explain the factors which affect the heat resistance of microorganisms. **07**

Q.2 **(a)** Write expressions for moisture content on dry basis and wet basis and establish a relationship between them. Ten kilogram of a food product is dried from an initial moisture content of 320% dry basis to 50% moisture on wet basis. Determine the amount of water removed during the process. **07**

(b) Explain unsteady state mass balance operation with an example. A well stirred tank of 10 liter volume contains salt solution having a concentration of 100 g/l. If pure water is continuously fed into this tank at a constant rate of 12 liters/hour and the volume of liquid inside the tank is maintained constant by continuously overflowing the excess liquid, calculate the concentration of salt solution (g/l) in the tank after 1.5 hours. **07**

OR

(b) Define the following terms and write their SI units: **07**

(i) Enthalpy (ii) Specific Heat

(iii) Specific heat at constant pressure (iv)Thermal conductivity

Calculate the amount of cooling water required to cool a liquid food paste from 85 ^{o}C to 20 ^{o}C flowing in a counter-flow heat exchanger @ 100 kg/h. The permitted increase in the temperature of the cooling water is 8 ^{o}C. The specific heats of the liquid food paste and water are 2.85 and 4.18 kJ/kg K respectively.

Q.3 **(a)** Differentiate between drying and evaporation of food by giving some examples. A food product having an initial moisture content of 77% w.b. is being dried at a constant rate of 0.1 kg/m^2 s until its moisture content becomes 30% w.b. Calculate the time required for drying if the product is in the form of a cube of size 5cm and its initial density is 950 kg/m^3. **07**

(b) Differentiate between ideal and actual screens and define the following: **07**

(i) US and Tyler Mesh Series

(ii) Overflow and Underflow.
(iii) Fineness Modulus
(iv) Cut-off particle diameter

OR

Q.3	**(a)**	Mention the various engineering properties of food materials and state the purpose of studying their physical properties with examples. Clearly define the terms ‘roundness’ and ‘sphericity’ stating their significance.	**07**
	(b)	Explain the basic modes of heat transfer in food processing. A cold storage wall of size 6m x 3m is constructed from 20 cm thick concrete. An insulation is to be provided on the inside of the wall to limit the heat transfer rate through the wall below 600 W. If the outside temperature of the wall is 40 ^{o}C and the inside temperature is to be maintained at 5 ^{o}C, calculate the thickness of the insulation material required. The thermal conductivities of concrete and the insulating material are 1.4 and 0.05 W/m ^{o}C respectively.	**07**
Q.4	**(a)**	Define food and explain the major functions of food.	**07**
	(b)	Describe the effects of radiations on the various constituents of food.	**07**

OR

Q.4	**(a)**	Explain the nature of food spoilage caused by bacteria, yeast and mold.	**07**
	(b)	Explain the role of physical factors in causing the food spoilage.	**07**
Q.5	**(a)**	Write the ideal characteristics of packaging material and explain the product package compatibility for food.	**07**
	(b)	Explain the different process of irradiation of foods.	**07**

OR

Q.5	**(a)**	Explain the role of plastics as a packaging material in food.	**07**
	(b)	Define water activity and explain the relationship between water activity and shelf life of food.	**07**

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