Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – WINTER 2015

Subject Code: 141405 **Date:06/01/2016**

Subject Name: Principles of Food Engineering

Time: 02:30pm to 05:00pm **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)** What are the requirements an effective food packaging must serve? Mention various types of packaging materials for food products and their applications. **07**

(b) Calculate the total mass balance and component balance for mixing of ingredients to make 25 kg of beef sausages having a fat content of 30%. The sausages is to be made by mixing of beef meat containing 18% protein, 12% fat and 68% water and beef fat containing 78% fat, 12% water and 5% protein. Draw a process diagram showing material flow streams. **07**

Q.2 **(a)** A 2 cm thick steel pipe is being used to convey steam from a boiler to process equipment for a distance of 40 m. The inside pipe surface temperature is 115^0C and the outside is 90^0C. Calculate the total heat loss to the surroundings and the steady state heat conduction through the pipe wall. **07**

(b) Explain the concept and significance of water activity in food processing. How is water activity expressed mathematically? Discuss the relationship between the water activity and shelf life of food. Mention some methods of reducing water activity in foods with examples. **07**

OR

(b) Explain the effect of radiation on food and also physical properties of food materials. **07**

Q.3 **(a)** Give processing steps that are taken prior to irradiation of foods. Mention the factors on which bactericidal efficiency of a given dose of irradiation depends. **07**

(b) Define food spoilage. Enlist the causes of food spoilage and explain microbial spoilage in detail. Also enlist the nutritional constituents and briefly discuss the function of food. **07**

OR

Q.3 **(a)** Define rheological properties. State with the help of a graph what is bio-yield point, rupture point and adhesiveness. **07**

(b) Write about (i) Evaporation (ii) Specific steam consumption (iii) Extraction (iv)Homogenization (v) Multiple effect evaporators (vi) Leaching (vii) Centrifugation. **07**

Q.4 **(a)** Differentiate between drying and evaporation and give examples for each. 50 kg of Cottage Cheese having a typical average heat transfer area of 1 m^2 is to be dried from 50 % moisture content to 20 % moisture content by using hot air at a temperature of 150^0C. Calculate the drying rate in kg/h and the drying time in hours. The surface temperature of the product is at 40^0C and the latent heat of vaporization (h_{fg}) at 40^0C is 2407 kJ/kg. Take h = 12 W/m^2 K. **07**

(b) A 200 kg ready to eat food sample was made containing 100 kg water and 50 kg **07**

total dry solids. Calculate the moisture content on % dry basis and % wet basis.

OR

Q.4	**(a)**	Explain the classification of foods as per the nature of stability with suitable examples.	**07**
	(b)	Give importance of thermal process time. Also give effect of temperature on reaction rate.	**07**
Q.5	**(a)**	List out different engineering properties of food materials. Explain roundness, sphericity and purpose of studying their physical properties.	**07**
	(b)	Derive an expression for conductive heat transfer through a multi-layered slab system.	**07**

OR

Q.5	**(a)**	Explain non steady system, freezing process, distillation and crystallization.	**07**
	(b)	Explain the need and methodology to determine the radiation doses for irradiation of specific foods. What kind of nuclear radiations are commonly employed for food preservation?	**07**

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