Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2018

Subject Code:2141407 Date:12/12/2018

Subject Name:Food Drying & Dehydration

Time: 02:30 PM TO 05:00 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)**	What is equilibrium moisture content? Write its significance also.	**03**
	(b)	Differentiate between direct and indirect dryer. List out the characteristics and properties of various types of dry powders and particulate.	**04**
	(c)	Describe the drying rates periods for agricultural products. Derive equation for constant rate drying.	**07**
Q.2	**(a)**	List out all the unique features of drying.	**03**
	(b)	Discuss Parallel, Series and Krisher models to predict thermal conductivity.	**04**
	(c)	The initial moisture content of a food product is 70% (wet basis), and the critical moisture content is 25% (wet basis). If the constant drying rate is 0.1 kg $H_2O/(m^2s)$, compute the time required for the product to begin the falling rate drying period. The product has a cube shape with 5-cm sides, and the initial product density is 900 kg/m^3.	**07**
		OR	
	(c)	Draw the following generalised curve for the agricultural materials: (i) Drying curve (ii) Drying rate curve (iii) Water activity stability diagram (iv) Moisture content and bed depth for different inlet temperature	**07**
Q.3	**(a)**	Compute the equilibrium moisture content for popcorn at 20°C and 50% relative humidity. Given that constant c = 6.5 x 10^{-4} and n=1.8	**03**
	(b)	What is moisture sorption curve? Describe the phenomena of hysteresis.	**04**
	(c)	(i) Define wet and dry basis moisture content and write the expression to convert wet basis to dry basis moisture content. (ii) 500 kg of paddy at 22 % moisture content (wb) is dried to14 % moisture content (wb) for milling. Calculate the amount of moisture removed in drying	**07**
		OR	
Q.3	**(a)**	Discuss in brief the features of solar drying.	**03**
	(b)	Give a detail classification of dryers used in food industry.	**04**
	(c)	A food containing 80% water is to be dried at 100°C down to moisture content of 10%. If the initial temperature of the food is 21°C, calculate the quantity of heat energy required per unit weight of the original material, for drying under atmospheric pressure. The latent heat of vaporization of water at 100°C and at standard atmospheric pressure is 2257 kJ kg^{-1}. The specific heat capacity of the food is 3.8 kJ kg^{-1} $°C^{-1}$ and of water is 4.186 kJ kg^{-1} $°C^{-1}$. Find also the energy requirement/kg water removed.	**07**
Q.4	**(a)**	Discuss the advantage of osmotic dehydration.	**03**

	(b)	What are the major chemical changes that take place during drying of food materials?	**04**
	(c)	A cabinet dryer is being used to dry a food product from 70 % moisture content (w.b.) to 6% moisture content (w.b.). The drying air enters the system at 54 ^{0}C and 10% RH and leaves at 30 ^{0}C and 70% RH. The product temperature is 25 ^{0}C throughout. Calculate the quantity of air required for drying on the basis of 1 kg of product solid. Given absolute humidity of air at 30 ^{0}C & 70% RH=0.0186 kg H_2O/kg dry air 54 ^{0}C & 10% RH=0.0094 kg H_2O/kg dry air	**07**

OR

Q.4	**(a)**	Define thin layer and deep bed drying.	**03**
	(b)	Describe the physical properties of dried foods.	**04**
	(c)	Write short notes on: (i) Water activity (ii) Rehydration ratio (iii) Shrinkage during drying (iv) Heat utilization factor	**07**
Q.5	**(a)**	What are features of fluidized bed dryer?	**03**
	(b)	Describe the principle for selection of dryer in food industry.	**04**
	(c)	Explain the construction, working and application of following: (i) Freeze Dryer (ii) Spray Dryer	**07**

OR

Q.5	**(a)**	Explain the concept of hybrid drying.	**03**
	(b)	What is heat pump dryer? Explain its working.	**04**
	(c)	Describe the construction and features of super heated steam drying?	**07**