

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 $0.1 \text{ kg H}_2\text{O}/(\text{m}^2\text{s})$, 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: **07**
 - (i) Drying curve
 - (ii) Drying rate curve
 - (iii) Water activity stability diagram
 - (iv) Moisture content and bed depth for different inlet temperature
- Q.3**
- (a) Compute the equilibrium moisture content for popcorn at 20°C and 50% relative humidity. Given that constant $c = 6.5 \times 10^{-4}$ 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. **07**
(ii) 500 kg of paddy at 22 % moisture content (wb) is dried to 14 % moisture content (wb) for milling. Calculate the amount of moisture removed in drying
- 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 $3.8 \text{ kJ kg}^{-1} ^\circ\text{C}^{-1}$ and of water is $4.186 \text{ kJ kg}^{-1} ^\circ\text{C}^{-1}$. 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 °C and 10% RH and leaves at 30 °C and 70% RH. The product temperature is 25 °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 °C & 70% RH=0.0186 kg H₂O/kg dry air

54 °C & 10% RH=0.0094 kg H₂O/kg dry air

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: **07**

(i) Water activity

(ii) Rehydration ratio

(iii) Shrinkage during drying

(iv) Heat utilization factor

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: **07**

(i) Freeze Dryer

(ii) Spray Dryer

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**