

GUJARAT TECHNOLOGICAL UNIVERSITY**B. E. Sem. – IV - Examination –June- 2011****Subject code: 141405****Subject Name: Principles of Food Engineering****Date:13/06/2011****Time: 10.30 am – 01.00 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) Explain the classification of foods as per the nature of stability with suitable examples. **07**

(b) Write expressions for mass balance for steady and unsteady state food processing operations. How much water must be removed from 200 kg of fresh apple juice containing 5% total solids to obtain concentrated juice containing 30% total solids? Draw a process flow diagram indicating various streams during the concentration process. **07**

Q.2 (a) Define thermal death time and explain the importance of thermal death time in food preservation. **07**

(b) Prove that moisture content on wet and dry basis are interrelated as **07**

$$\frac{1}{MC_{wb}} = \frac{1}{MC_{db}} + 1$$

A 200 kg ready to eat food sample was made containing 100 kg water and 50 kg total dry solids. Calculate the moisture content on % dry basis and % wet basis.

OR

(b) Ten kilogram of a food product was formulated containing 15% protein ($C_p = 2037.6 \text{ J/kgK}$), 1% fiber ($C_p = 1891.3 \text{ J/kgK}$), 20% starch ($C_p = 1593.8 \text{ J/kgK}$), 0.5% ash ($C_p = 1137.5 \text{ J/kgK}$), 20% fat ($C_p = 2018 \text{ J/kgK}$), and 43.5% water ($C_p = 4184.9 \text{ J/kgK}$). Calculate the following: **07**

- (i) The average specific heat of the formulated food in J/kgK
- (ii) The amount heat required in kJ to raise the temperature of the product from 25 °C to 85 °C

Q.3 (a) Enlist various methods of food preservation and explain any one in detail. **07**

(b) Enlist and explain the physical factors which cause the spoilage of foods. **07**

OR

Q.3 (a) Explain the methodology to determine the radiation doses for irradiation of specific foods. **07**

(b) State the objective of food packaging and write the requirements for effective food packaging. **07**

Q.4 (a) Explain in detail about the physiological functions of food. **07**

(b) Write short notes on following:- **07**

1. Aseptic processing and packaging of food.
2. Use of metals in packaging of foods.

OR

Q.4 (a) A potato peeling machine uses low pressure steam @ 4 kg/h to peel raw potatoes fed into the machine @ 100 kg/h. The unpeeled raw potatoes enter the machine at 17 °C and the peeled potatoes leave the machine at 35 °C. The waste stream containing waste water and peel leaves the machine at 60 °C. If the heat content of the supplied steam is 2750 kJ/kg, determine the rate of peeled potatoes coming out of the machine in kg/h and the waste stream flow rate in kg/h. The specific heats of raw potatoes, waste stream and the peeled potatoes are 3700, 4200 and 3500 J/kg K respectively. **07**

(b) Name different types of dryers and evaporators used in food processing industries. A triple effect falling film evaporator is being used for concentrating a liquid food from 11% concentration to 50% concentration. If the mass flow rate of the feed is 1000 kg/h and steam is supplied @ 250 kg/h, calculate the following: **07**

- (i) Concentrated product output in kg/h.
- (ii) Rate of water evaporation in kg/h.
- (iii) Steam economy in kg water evaporated per kg steam.

Q.5 (a) Write meaningful explanatory notes on the following unit operations giving appropriate examples for each: **07**

- (i) Distillation
- (ii) Extraction
- (iii) Crystallization

(b) Explain constant and falling rate of drying process with the help of moisture content versus time plot. A food product is being dried from 77% wet basis moisture content to 30%. Calculate the drying time if the constant rate of drying is 15 gram per second. **07**

OR

Q.5 (a) Define sieving and state how sieves are designated. A 300 gram sample of a grain was put to analysis for clean grain fraction on a air screen grain cleaner. The following data were obtained: **07**

Sample Fraction	Feed	Clean grain Outlet	Blower Outlet	Overflow Outlet	Underflow Outlet
% Clean Grain	94	99	0.5	1	0.2
% Impurities	6	1	99.5	99	99.8

Calculate the % cleaning efficiency of the screen.

(b) What are rheological properties of foods? Explain the following terms with appropriate examples: **07**

- (i) Bingham plastic fluid
- (ii) Newtonian fluids
- (iii) Hookien deformation
- (iv) Plasticity of material
- (v) Viscous flow
