

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – WINTER • 2014****Subject Code: 141405****Date: 02-01-2015****Subject Name: Principles of Food Engineering****Time: 02:30 pm - 05:30 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)** Draw a labeled flow diagram of a single effect falling film evaporator indicating various process streams. A forced circulation evaporator is concentrating pineapple juice from 12% solids to 48 % moisture content. The mass flow rate input to the evaporator is 5 tonne per hour and the steam consumption is 0.75 kg/s at 8 bar. Calculate: **07**
- (i) Concentrated apple juice output rate
 - (ii) Water evaporation rate
 - (iii) Steam economy and specific steam consumption

- (b)** Define food spoilage and explain the nature of food spoilage caused by yeast and mold. **07**

- Q.2 (a)** Calculate the amount of cooling water required to cool a liquid food paste at the rate of 100kg/hr, containing 40% solids from 85 to 20°C in a counter flow heat exchanger. The increase in temperature of water is not allowed to exceed 8°C. The specific heat of liquid food paste is 2.85 and water is 4.18KJ/kg k. **07**

- (b)** Write short notes on; **07**
- a) Requirements for ideal food packaging
 - b) Aseptic processing and packaging of food.

OR

- (b)** Define the following terms and write their SI units: **07**
- (i) Enthalpy
 - (ii) Specific Heat
- Air is contained in a closed, rigid and well insulated tank of volume 200 liter. The tank is fitted with a paddle wheel which transfers energy to the air at a constant rate of 4 W for 20 minutes. Draw the energy interaction diagram for the system and calculate the change in internal energy of the system in kJ/kg after 20 minutes. The specific volume of air is 0.833 m³/kg.

- Q.3 (a)** State the importance of radiation as a method of food preservation and explain the criteria to decide the radiation dose for food irradiation. **07**

- (b)** Draw a diagram and set up a total mass and component balance equation for a crystallizer where 100 kg of a concentrated sugar solution containing 85% sucrose and 1% inert, water-soluble impurities (balance, water) enters. Upon cooling, the sugar crystallizes from solution. A centrifuge then separates the crystals from a liquid fraction, called the mother liquor. The crystal slurry fraction has, for 20% of its weight, a liquid having the same composition as the mother liquor. The mother liquor contains 60% sucrose by weight. **07**

OR

- Q.3 (a)** Explain the term 'Thermal Death Time' with its importance in food preservation. **07**

- (b) Differentiate between cleaning, grading and sorting. Explain the working of hand operated double screen grain cleaner with diagram. 07
- Q.4** (a) Enlist various methods of preservation and explain the method to preserve the milk for short period. 07
- (b) Write meaningful explanatory notes on the following giving suitable examples for each: 07
- (i) Extraction
 - (ii) Centrifugation
 - (iii) Homogenization
 - (iv) Water activity
 - (v) Solid-Liquid Leaching
- OR**
- Q.4** (a) Discuss the followings in brief; 07
1. Sensible heat
 2. Angle of repose
 3. Particle density
 4. Importance of physical properties
- (b) Differentiate between drying and evaporation of food by giving some examples. A food product having an initial moisture content of 80 % w.b. is being dried at a constant rate of 0.2 kg/m²s until its moisture content becomes 24% w.b. Calculate the time required for drying if the product is in the form of a sphere of 4 cm diameter and its initial density is 850 kg/m³. 07
- Q.5** (a) Give the importance of rheological properties application of TPA in food processing. Define Cohesiveness, Hardness and Chewiness. 07
- (b) Describe the factors affecting heat resistance of micro-organisms. 07
- OR**
- Q.5** (a) Define water activity and explain its role in preservation of food. 07
- (b) Write the important characteristics of 'Metals' and 'Plastics' as a food packaging material. 07
