Seat No.: _____ Enrolment No._____

# 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 $20^0$C in a counter flow heat exchanger. The increase in temperature of water is not allowed to exceed $8^0$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 $m^3$/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 $kg/m^2s$ 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 $kg/m^3$. **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**

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