Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: 141405 **Date: 30-12-2013**

Subject Name: Principles of Food Engineering

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)** State the law of conservation of energy and write expressions for steady and non-steady state unit operations with a good example. 20 kg of nitrogen gas having a constant specific heat C_v of 2.6 kJ/kg K is being mechanically stirred in a sealed rigid tank causing a temperature rise of 17 ^oC. If 15kJ of heat is lost to the surroundings during the process, calculate the change in internal energy and the work done during the process. **07**

(b) Milk with 3.8% fat and 8.1% fat free solids (FFS) is used for the production of canned concentrated milk. The process includes the separation of cream in a centrifuge and concentration of the partially defatted milk in an evaporator. If the cream that is produced in the centrifuge contains 55% water, 40% fat and 5% FFS, calculate how much milk is necessary in order to produce a can of concentrated milk that contains 410g milk with 7.8% fat, 18.1% FFS. How much cream and water must be removed in the centrifuge and the evaporator respectively **07**

Q.2 **(a)** Define food spoilage and state its underlying causes. Explain the nature of food spoilage caused by microorganisms. **07**

(b) Explain in detail the requirements for ideal food packaging? **07**

OR

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

i) Functions of Food packaging.

ii) Polyethylene film as a packaging material.

Q.3 Differentiate between constant and falling rate drying. Give some example of evaporators and dryers used in food industry. A multiple effect evaporator concentrates clarified mango juice from 11% total solids to 50% total solids. The mango juice is being fed to the evaporator at a constant rate of 300 kg/h and the corresponding steam consumption rate is 1200 kg/h. Determine the following: (i) Concentrated mango juice output rate. **07**

(ii) Water evaporation rate.

(iii) Specific steam consumption.

(iv) Steam economy.

(b) Explain ANY FIVE of the following: **07**

(i) Distillation (ii) Leaching

(iii) Homogenization (iv) Critical Moisture content

(v) Cut-off particle diameter (vi) Steam economy

OR

Q.3 **(a)** What is the purpose of drying in food processing? Explain constant and falling rate drying with the aid of 'Drying Rate Vs. Time curve'. A tray dryer dries 5 kg raisins from 77% moisture content to 30% moisture content as stage-I drying at a constant rate of 1g/s. Calculate the drying time in minutes. **07**

(b) Write meaningful short notes on ANY FIVE of the following: **07**
(i) Crystallization (ii) Centrifugation
(iii) Temporary methods of food preservation.
(iv) Chewiness of foods.
(v) Convection heat transfer.
(vi) Evaporators.

Q.4 **(a)** Enumerate the need to study the physical properties of food material. Explain the application of frictional properties with an example. Define angle of repose and state its significance. **07**

(b) Explain the following: **07**
(i) Roundness (ii) Thermal conductivity
(iii) Conduction (iv) Bulk density
(v) Sphericity

OR

Q.4 **(a)** Mention thermal properties of food material and give their SI units.. Calculate approximate specific heat of a custom food material having carbohydrate 40%, protein 20%, fat 10%, ash 5% and moisture 25%. **07**

Q.4 **(b)** Mention various nutrients present in food products and state their specific functions. **07**

Q.5 **(a)** Discuss the importance of thermal process time. **07**

(b) Explain the concept and significance of water activity in food processing. How is water activity expressed mathematically? Mention some methods of reducing water activity in foods with examples. **07**

OR

Q.5 **(a)** What is 'Thermal Death Time'? Discuss the importance of thermal death time in food preservation. **07**

(b) Discuss in detail radiation processing of foods with examples. **07**

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