

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 °C. 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 1 g/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**
