

Roll No.....

Total No. of Printed Pages: [02]

Total No. of Questions: [09]

B.Sc. (Food Tech.)/B.F.S.T (Hons.) (Semester – 5th)

UNIT OPERATIONS IN FOOD ENGINEERING

SUBJECT CODE: BFOTS1 -501

Paper ID: [19131723]

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a. Explain the working principles of freeze dryers and its utility in processing industry.
- b. Describe with the help of process diagram working principal operation of multiple effect evaporator.
- c. Calculate the energy requires for the comminution of solids according to Rittinger's Law. If particle size is required from 100mm to 50mm
- d. Graphically represent the freezing process and explain Plank's Equation for determination of freezing time of a food material.
- e. Draw the refrigeration cycle and derive the mathematical expression used in the mechanical refrigeration system.
- f. What are the objectives of Pasteurization?
- g. Explain the working of hammer and disc mill with a diagram.
- h. Describe various types of mills used in size reduction operation. Give neat sketches for description.
- i. What are the different types of screens used in food industry and the factors affecting the efficiency of screen?
- j. Write note on open circuit grinding and closed circuit grinding.

Section – B

(5 marks each)

Q2. Define Pasteurization. What is its purpose and objectives? Differentiate between LTLT and HTST pasteurization.

Q3. a) Fresh orange juice containing 8% solids concentrated in an evaporator to 55% solids. If the juice is entering at 500kg/hr .Calculate the amount of water removed and concentrated juice produced.

b) Give the constructional and working detail of falling film evaporator.

- Q4. Explain factors affect the selection of refrigerant? Draw and explain the pressure enthalpy chart for refrigeration cycle.
- Q5. a) Drive the equation of Kick's law to be used for energy requirement for the size reduction.
b) Food is milled from 6mm to 0.0012 mm by 10 hp motor. Would this motor be adequate to reduce the size of the particles to .0008mm? Apply Rittinger's equation.
- Q6. Write down the various methods used for sorting and grading of different food materials along with its advantages.

Section – C

(10 marks each)

- Q7. Describe with the help of process diagram, the design calculations and application of screw conveyor.
- Q8. A Spherical food product is being frozen in an air blast freezer. The initial product temperature is 10°C and the cold air is supplied at -40°C. The product has a 7cm diameter with a density of 1000/m³. Compute the freezing time of the initial freezing product. Temperature of a product is -1.25°C, $K=1.2 \frac{W}{m^0C}$, L is $250 \times 10^3 \frac{J}{Kg}$ and $h=50 \frac{W}{m^0C}$.
- Q9. A triple effect evaporator uses steam to the first effect at 108°C and the boiling point of liquid in last effect is 52°C. The OAHTC in J/M² s°C are 2500 in first effect, 2000 in second effect, 1000 in the third effect. Neglect boiling point elevation and assume equal heat transfer rate and heat transfer area in each effect. At what temperature will the liquid boil in each effect? Find out the enthalpy of vapor leaving each effect.