

B SC FOOD SC & TECHNOLOGY
Third Semester
Food Process Engineering-II
(BFST-307)

Duration: 3Hrs.

Full Marks: 70

Part-A (Objective) =20
Part-B (Descriptive) =50

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins.

Marks: 50

Answer any four from Question no. 2 to 8
Question no. 1 is compulsory.

1. What are the 3 modes of heat transfer? Define them with expression. One face of Stainless Steel plate of 1cm thickness is maintained at temperature 120°C & other face is maintained at 100°C. Calculate rate of heat transfer per unit area if thermal conductivity $K=17 \text{ W/m}^\circ\text{C}$ using Fourier's Law. (6+4=10)

2. What are heat exchangers? Explain in brief any four heat exchangers. (2+8=10)

3. What is PHE? A heat exchanger is used to heat orange juice from 18°C to 80°C at a flow rate of 0.5 kg/sec. A counter current heat exchanger is required and hot water is available at 95°C to pass through annular pipe at a flow rate of 1.5 kg/sec. Specific Heat of juice is 3.89 kJ/kg°C. Calculate length of the inner juice pipe having a diameter of 8 cm & overall heat transfer coefficient is 2400 W/m²°C.

(2+8=10)

4. Define the terms thermal conductivity & thermal diffusivity? Write down the relation between Thermal Conductivity & Thermal Diffusivity? Determine the thermal diffusivity of soyabean grains, if the Thermal Conductivity is 0.3 kcal/mh °C. Specific heat is 0.4 kcal/kg °C & bulk density is 640 kg/m³. (4+1+5=10)

5. Define thawing. A cold storage plant is required to store 25 tonnes apples. The following data are given: Initial temperature of apples = 30°C , refrigerator storage temperature = 2°C , Specific heat of apple above freezing point = $0.87 \text{ kcal/kg}^{\circ}\text{C}$. If cooling is achieved within 8 hrs. Determine – (2+8=10)

a. Capacity of the refrigeration plant.

b. C.O.P of carnot cycle between the temperature range.

c. If actual C.O.P is 25% of carnot C.O.P. find out Horse Power required to run the plant.

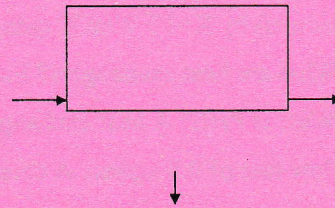
6. Define refrigeration. Explain the vapour compression cycle with diagram.

(2+8=10)

7. What is the advantage of mechanical handling devices over human labour.

Describe the four most common type of mechanical handling devices used in food industry. (2+8=10)

8. Write in brief about utilization of steam in food industries



Mass of feed, $m_f = 100 \text{ kg}$, mass of product, $m_p = ?$, mass of steam, $m_s = 4 \text{ kg}$, mass of waste stream, $m_w = ?$, enthalpy of steam, $H_s = 2750 \text{ kJ/kg}$, temperature of feed, $T_f = 17^{\circ}\text{C}$, temperature of waste stream, $T_w = 60^{\circ}\text{C}$ and temperature of product, $T_p = 35^{\circ}\text{C}$ (4+6=10)



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Duration: 20 minutes

Marks – 20

(PART A - Objective Type)

1. Fill in the blanks:

1×10=10

- a. For grain conveying in belt conveyer, belt speed of _____ is recommended.
- b. In belt conveyer, a trough angle of _____ is best suited for paddy & other grain.
- c. Bucket elevators with a belt carrier can be used at fairly high speed of _____.
- d. Cold storage temperature should be _____.
- e. _____ is the process of conversion of ice to water.
- f. Plate heat exchangers is used in _____ units for heating _____ below its boiling point.
- g. Heat content of a material is _____.
- h. Expression for Fourier's law is _____.

2. Mention the Full Forms of the following:

1×4=4

- a. COP
- b. UHT
- c. CIP
- d. PHE

3.Mention whether True or False.

1×6=6

- a.Selection of 'belt' for a belt conveyer will depend on capacity requirement, speed of operation, and angle of inclination of belt conveyer.
- b.Blowing system is type of Pneumatic conveyer.
- c.Energy level of a material is called Enthalpy.
- d.Radiation does not need any medium between two bodies.
- e.Thermal conductivity is affected by percent void space.
- f.Second law of thermodynamics states that heat flows from lower temperature to higher temperature irrespective of material & mass of the bodies through which heat flows.
