

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2021****Subject Code:3151404****Date:09/09/2021****Subject Name:Food Engineering Operation-1****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Define terminal velocity. How the density affects the terminal velocity? **03**
- (b) Differentiate between thermodynamics and heat transfer. Derive the equation for Conductive Heat Transfer in a Rectangular Slab. **04**
- (c) What is fineness modulus? The mass retained over the IS set of sieves during sieve analysis is given below in the table. Calculate fineness modulus and average particle diameter. **07**

IS screen number	100	70	50	40	30	20	15	Pan
Mass retained (g)	0	1.8	20.4	40.4	108.3	114.7	4.6	9.8

- Q.2** (a) List out the application of mass transfer in food processing. **03**
- (b) Discuss in brief the design consideration of air screen grain cleaner. **04**
- (c) Explain briefly the Bond's law for energy requirement in size reduction. How much power is required to crush 500 kg/h of a food material if 80% of the feed passes through IS sieve No. 340 (3.25 mm opening) and 80% of the product passes through IS sieve No. 50 (0.5 mm opening)? Given the work index of the material is 6.75. **07**

OR

- (c) What do you understand by Newton's Law of cooling for convection? Discuss free and forced convection in details also write the equation to calculate Nusselt Number for spherical bodies. **07**
- Q.3** (a) Describe different types of screen opening. **03**
- (b) Determine the screen effectiveness for an IS 50 mesh (opening size 0.5 mm) for which the cumulative mass fractions of feed, overflow and underflow is given as 0.16, 0.615 and 0.03 respectively. **04**
- (c) Describe the working of: **07**
- (a) Magnetic separator
 - (b) Specific gravity separator.

OR

- Q.3** (a) What are the advantages of modern storage structures? **03**
- (b) Differentiate between direct and indirect damage of grains during storage. **04**
- (c) Enlist different types of traditional storage structures for grains. Describe the important features of any two of them. **07**
- Q.4** (a) Give a neat sketch of Texture Profile Analysis (TPA), compresses a bite-sized piece of food of twice to simulate the chewing action of the teeth. **03**

- (b) What are different types of bucket elevators used in food industry? Explain any one of them. **04**
- (c) Describe the components and important design features of belt conveyor used in food industry. **07**

OR

- Q.4 (a)** Calculate the specific heat of a food product at 20°C with the approximate composition data given in Table **03**

Components	Water	Carbohydrate	Protein	Fat	Ash
Weight (%)	8.5	75.3	14.1	0.7	1.4

- (b) Discuss Physical and Frictional properties of food materials with its application in food processing. **04**
 - (c) One face of a stainless-steel plate 1 cm thick is maintained at 110°C, and the other face is at 90°C. Assuming steady-state conditions, calculate the rate of heat transfer per unit area through the plate. The thermal conductivity of stainless steel is 17 W/(m °C). **07**
Derive the equation of Heat Transfer through a composite wall in series.
- Q.5 (a)** Define the followings **03**
1. Cohesiveness
 2. Shear Thinning
 3. Dynamic Angle of repose
- (b) Explain specific heat and thermal diffusivity and also explain the effect of both of them in processing of food products. **04**
 - (c) Discuss the principle and theory of diffusion. Explain the diffusion of oxygen from air into water through gas liquid interphase. **07**

OR

- Q.5 (a)** Describe briefly the working of vibratory air screen cleaners. **03**
- (b) Mention some measures to control damage by rats during grain storage **04**
 - (c) Classify fruits and vegetables based on their storage potential. Mention five cold store design requirements. **07**
