Seat No.: Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3151404 Date:27/01/2021

Subject Name:Food Engineering Operation-1

Time:10:30 AM TO 12:30 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Write the equations of following non dimensional numbers **03**

1. Nusselt Number
2. Grashof Number
3. Prandtl Number

(b) Discuss thermal conductivity of food materials. Also discuss Parallel Model, Series (Perpendicular) Model and Krischer Model for prediction of thermal conductivity. **04**

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

a. Pneumatic conveyor
b. Bucket elevators
c. Screw conveyors

Q.2 **(a)** Differentiate between shallow and deep bin. **03**

(b) Write the construction and working of rotary air screen cleaners **04**

(c) What are laws of size reduction and energy calculation? In a wheat milling experiment, it was found that to grind 4 mm sized grains to IS sieve 35 (0.351 mm opening), the power requirement was 10 Kw. Calculate the power requirement for milling wheat by the same mill to IS sieve 15(0.157 mm opening) using Rittingers' law. Feed rate of milling is 180 kg/h. **07**

Q.3 **(a)** Describe the importance of shape of food products in food processing. Differentiate between sphericity and roundness. **03**

(b) What do you understand by optical and electrical properties of food materials? Give some of its application in food processing. **04**

(c) A cold store has a wall comprising of 11cm of bricks on the outside then 7.5cm of concrete and then 10cm of cork. The temperature within the store is maintained -18^0C and outside temperature of the wall is at 18^0C. Calculate the rate of heat transfer. The thermal conductivities are for bricks, concrete and cork 0.69, 0.76 and 0.043 J/ms^{0}C. Also determine the temperature at interfaces between concrete and cork layers and bricks and concrete layers. **07**

Q.4 **(a)** Mention types of idlers used in belt conveyor with diagram. **03**

(b) Define rheological properties of food materials. Discuss angle of repose with diagram. **04**

(c) Give one design parameters for each of the following factors for designing of air screen cleaners: **07**

a. Feeding Mechnism
b. Size of screen surface
c. Grain bed depth
d. Shape of the screen opening
e. Percentage open (perforated) area
f. Angle of inclination
g. Vibrational amplitude and frequency

Q.5 **(a)** Write two modern storage structures used for grain storage. Mention three important features of one of them. **03**

(b) Discuss briefly the sources of infestation in grain storage. **04**

(c) Explain the method of volume measurement with diagram by **07**

1. Gas Displacement method
2. A platform scale method

Q.6 **(a)** What do you understand by Newton's Law of cooling for convection? Explain specific heat and thermal diffusivity **03**

(b) Differentiate between **04**

1. Particle Density and Bulk Density
2. Open pore Porosity and Bulk Porosity

(c) Explain absorbivity, reflectivity, transmissivity and emissivity. What is Kirchhoff's law and Stefan- Boltzmann law? **07**

Q.7 **(a)** Define the followings **03**

1. Closed pore porosity
2. Diffusion in mass transfer
3. Total Porosity

(b) Describe the important features of Pusa bin **04**

(c) Describe the working of Specific Gravity Separator with diagram. **07**

Q.8 **(a)** Define (a) screen analysis (b) Mesh (c) Ideal screen **03**

(b) Discuss the concept of controlled and modified atmosphere storage in agricultural produce. **04**

(c) What do you understand by Newton's Law of cooling for convection? Explain specific heat and thermal diffusivity **07**

****