

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – WINTER • 2014****Subject Code: 151404****Date: 02/05/2015****Subject Name: Food Engineering Operations-I****Time: 02.30pm-05.00pm****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) Explain principle, construction and working of blade jaw crusher with figure. **14**
Differentiate between;

1. Sphericity and Roundness
2. Newtonian and Non-Newtonian fluids
3. Gumminess and Chewiness
4. Dynamic and Static angle of repose
5. Solid volume and Apparent volume
6. Open pore porosity, Closed pore porosity
7. Thermal conductivity, Thermal diffusivity

Q.2 (a) One face of stainless steel plate thickness is maintained at 110⁰C, while the other face is at 90⁰C. Assuming steady state condition, calculate the rate of heat transfer per unit area through the plate. Thermal conductivity of stainless steel is 17W/m⁰C. **07**

(b) What do you understand by conductive heat transfer coefficient? Derive the following expression for multilayered system of rectangular slab and also show its electrical resistance analogy; **07**

$$q = \frac{T_2 - T_1}{\frac{\Delta x_B}{K_B A} + \frac{\Delta x_C}{K_C A} + \frac{\Delta x_D}{K_D A}}$$

OR

(b) Write a short note on belt conveyor. **07**

Q.3 (a) Define a plane of rupture. Differentiate shallow bin and deep bin on the basis of plane of rupture. With helps of diagrammatic representation briefly explain different types of flow patterns when emptying a vertical silo. **07**

(b) Explain the structure and composition of maize grain and give the reasons to study the chemical composition of food. Also prove that; **07**

$$\Phi = \frac{(lbt)^{1/3}}{l}$$

OR

Q.3 (a) 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. **07**

(b) What do you understand by Fick's law and mass transfer? Explain the process of diffusion. Discuss the Kirchoff's law and state the Stefan-Boltzmann law. **07**

Q.4 (a) Explain the principle, construction and working of an indented cylinder separator. **07**

(b) Enumerate the advantages of modern storage bins. Describe briefly different permanent storage structures with suitable diagrams. **07**

OR

Q.4 (a) Define a plane of rupture. Differentiate shallow bin and deep bin on the basis of plane of rupture. With helps of diagrammatic representation briefly explain different types of flow patterns when emptying a vertical silo. **07**

(b) Discuss the followings in brief **07**

1. Nominal stress and Normal stress
2. Structure of maize grain
3. Newtonian and Non-Newtonian liquid
4. Textural Profile Analysis (TPA)

Q.5 (a) Explain the construction and working of a grizzly screen. What would be the critical speed of rotation, in revolution per minute for wet grinding in viscous suspensions by a ball mill of 1600 mm diameter charged with 100 mm ball? **07**

(b) Derive the expression for Janssen's formula of lateral pressure exerted by granular materials against the wall in vertical deep bins. **07**

OR

Q.5 (a) Derive an equation for effectiveness of screen. Define ideal screen. Differentiate ideal and actual screen by using graph. **07**

(b) Define the followings **07**

1. Work index
2. Angle of repose
3. Aperture
4. Mesh
5. Grizzly
6. Volume surface mean diameter
7. Size reduction method followed by roll crusher
