Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – WINTER 2013

Subject Code: 151404 **Date: 27-11-2013**

Subject Name: Food Engineering Operations-I

Time: 10.30 am - 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.**

Q.1 (a) Differentiate between; **07**

1. Black body and Gray body
2. True density and Material density
3. Screw Conveyor and Pneumatic Conveying System
4. Newtonian and Non-Newtonian fluids
5. Bulk porosity and Bulk particle porosity
6. Static and Dynamic angle of repose
7. Thermal conductivity and Specific heat .

(b) Explain briefly Rittinger's law and kick's law and Bond's law for size reduction. Define crushing efficiency and mechanical efficiency in size reduction. Explain briefly the infestation by Rats and rat control measures while designing warehouse for storing grains. **07**

Q.2 (a) In a bucket elevator for lifting paddy, each bucket is 25 cm long and has a cross – section which is a section of a circle having a radius of 20 cm and substending an angle of 80 at the centre. The buckets are 40 cm apart, the lift is 20 m and the head wheel has a diameter of 60 cm. Calculate (i) belt speed so that the discharge is centrifugal. **07**

(ii) Capacity of lifting paddy weighing 580 kg/m^3.

(iii) Horsepower required assuming an overall efficiency of 85%.

(b) What is an ideal screen? Graphically represent the difference between ideal and actual screen. Derive an expression for screen effectiveness. **07**

OR

(b) Write short notes on following cleaning and grading equipments **07**

1. Specific gravity separator
2. Spiral separator

Q.3 (a) Derive the Janssen's formula of lateral pressure exerted by granular materials against the wall in vertical deep bins. Explain with respect to diagram of plane of rupture about shallow and deep bin. **07**

(b) What is the difference between convection and conduction? Derive the expression for multilayered system of cylinder and also show its electrical resistance analogy. **07**

OR

Q.3 (a) What do you understand by TPA? Explain the different textural properties with TPA diagram. **07**

(b) What is Kirchhoff's law and what is its significant. A loaf of bread passing through a baking oven, the walls of which are maintained at a constant temperature of 220^0C. The bread has an area of 0.09 m^2 and is at 100^0C. The emmisivity of bread may be taken as 0.52. In addition to the radiation heat , there is convective heat also by air at 220^0C. Calculate the heat transfer rate. **07**

Q.4 **(a)** What is diffusion? Write a short note on diffusional mass transfer. Explain the Fick's law of diffusion. **07**

(b) Calculate the true density of spinach at 25^0C having the composition in given table. **07**

Composition of Spinach	
Component	Composition (%)
Water	93.57
Protein	1.66
Fat	0.35
Carbohydrate	1.22
Ash	3.2

OR

Q.4 **(a)** What do you understand by terminal velocity? Derive the expression of terminal velocity for spherical body. **07**

(b) Give the following answers in brief **07**

1. Purposes to study physical properties
2. Why one study the chemical composition of grain?
3. Define the shape
   (1) Ovate
   (2) Elliptical
   (3) Ribbed
   (4) Irregular

Q.5 **(a)** Explain the detailed structure of rice grain and prove that; **07**

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

Kidney beans were procured as a samples and cleaned to ensure that grains were free of dirt, brokens and other foreign materials. The moisture content during the experiment was found to be 7.9% (w.b.). Calculate (i) Arithmetic mean diameter (ii) Geometric mean diameter. Given Width of grain = 7.25mm, Length of grain = 13.05mm, Thickness of grain = 7.04mm

(b) Give requirements of storage. Explain types of damage occurring during storage. Which are the source of infestation? How will you control rodents? **07**

OR

Q.5 **(a)** List the importance of frictional properties of material. On what factors a frictional property depends. Discuss traditional and improved storage structure and modified controlled atmospheric storage. **07**

(b) What is the expected percentage increase in convective heat transfer coefficient if the velocity of the fluid is doubled while all other parameters are kept the same for turbulent flow in pipe? **07**

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