Seat No.: _

Enrolment No._

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V(New) • EXAMINATION – WINTER 2016 Subject Code:2151404 Date:22/

Date:22/11/2016

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.
- Q.1 State the following sentences are TRUE or False
 - 1. Trommels are used to reduce size of grains.
 - 2. Ball mill works on the principle of impact.
 - 3. Angle of repose depends upon moisture content.
 - 4. In roll crusher both the rolls run at same speed.
 - 5. Short distance horizontal transportation of grain, gravel, sand, ash, asphalt etc. is done by using a bucket conveyor.
 - 6. Hardness is the textural property of material.
 - 7. Drying is a process of mass transfer.
 - 8. Sizing of fine materials, the most suitable equipment is a grizzly
 - 9. Crushing efficiency is the ratio of the surface energy created by crushing to the energy absorbed by the solid.
 - 10. Most suitable conveyor for transportation of sticky material is pneumatic conveyor.
 - 11. Increasing capacity of screens would increase screen effectiveness.
 - 12. Percentage elongation of a material is a measure of its brittleness.
 - 13. Silos are traditional storage structures.
 - 14. Jaw crusher's jaw reciprocates 250-400 times in a minute.
- **Q.2** (a) Discuss different types of pores present in food materials with diagram.
 - (b) With the help of diagram explain plane of rupture. Differentiate between shallow bin and 04 deep bin.
 - (c) Calculate the rate of heat loss through the vertical walls of a boiler furnace of size 4m by 07 3m by 3m high. The walls are constructed from an inner fire brick wall 25cm thick of thermal conductivity 0.4 W/mK, a layer of ceramic blanket insulation of thermal conductivity 0.2 W/mK and 8 cm thick, and a steel protective layer of thermal conductivity 55 W/mK and 2 mm thick. The inside temperature of the fire brick layer was measured at 600^o C and the temperature of the outside of the insulation 60^o C. Also find the interface temperature of layers.

OR

(c) Dynamic gassing out method is used to measure the $k_L a$ in a vessel. The oxygen gas is **07** stripped from the liquid medium, and then readmitted. The concentration of oxygen in the liquid at different time periods in the built-up zone is measured as follows: The average concentration was noted to be 7ppm. Calculate $k_L a$

Time (S)	0	5	10	15	20	25
O ₂ Con., ppm	0.5	1.7	2.7	3.5	4.2	4.7

- Q.3 (a) Explain the construction and working of an indented cylinder separator.
 - (b) What is the expected percent increase in convective heat transfer coefficient if the 04 velocity of the fluid is doubled while all other parameters are kept the same for turbulent

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flow in pipe?

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(c)	List out the application of mass fi	ranster in food processing
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OR

- Q.3 (a) Discuss the followings;
 - 1. Angle of repose
 - 2. Terminal velocity
 - 3. Non-Newtonian fluids
 - (b) What is work index? Define crushing efficiency and mechanical efficiency in size 04 reduction.
 - (c) Define mass transfer. Discuss the principle and theory of diffusion with single phase 07 system.
- Q.4 (a) Describe the Rittinger's law, kick's law and Bond's law for size reduction. 03
 - (b) Explain construction and working of bucket elevator with diagram. 04
 - (c) Discuss various modes of heat transfer. Derive the equation for conduction heat flow 07 through pipes in series.

OR

- Q.4 (a) Discuss the film theory in mass transfer with diagram. 03
 - (b) Discuss the followings; Aperture, Mesh, grizzly, Thermal diffusivity
 - (c) A spherical container of negligible thickness holding a hot fluid at 140^{0} C and having an **07** outer diameter of 0.4 m is insulated with three layers of each 50 mm thick insulation of $k_1 = 0.02$: $k_2 = 0.06$ and $k_3 = 0.16$ W/mK. (Starting from inside). The outside surface temperature is 30^{0} C. Determine (i) the heat loss, and (ii) Interface temperatures of insulating layers.
- Q.5 (a) Determine the screen effectiveness for an IS 50 mesh (opening size 0.5 mm) for which 03 the cumulative mass fractions of feed, overflow and underflow is given as 0.16, 0.615 and 0.03 respectively.
 - (b) Explain the difference between ideal screen and actual screen by using graph. 04
 - (c) Define continuous molecular diffusion. Discuss diffusion of oxygen from air in to water 07 through gas-liquid interphase with diagram.

OR

- Q.5 (a) Discuss the followings; Gumminess, Bingham fluid, Dilatant, Boundary volume and Bulk volume
 - (b) What do you understand by screen effectiveness? Derive the formula for screen 04 effectiveness.
 - (c) Explain convective mass transfer with diagram. On what parameters convective mass 07 transfer depends upon.

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