

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-Vth Examination December 2010****Subject code: 150502****Subject Name: Mechanical Operation****Date: 15 /12 /2010****Time: 03.00 pm - 05.30 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) Define filtration. Explain principle, construction and working of Rotary Drum filter. **07**
- (b) What is flow number? Derive the mathematical form of N_Q with all its consideration. **07**

- Q.2** (a) Define size reduction. A certain set of crushing rolls of 1000 mm diameter by 375 mm width of face. They are set so that the crushing surfaces are 12 mm apart at the narrowest point. The angle of nip is 30° . What is the maximum permissible size of feed? **07**

- (b) State and explain the different laws of size reduction with the importance of the work index in the size reduction. **07**

OR

- (b) Define fluidization. Explain the condition for fluidization with pressure drop and bed height vs. superficial velocity for bed of solids. **07**

- Q.3** (a) A bed of ion-exchange beads 8 ft deep is to be backwashed with water to remove dirt. The particles have a density 1.24 g/cm^3 and an average size of 1.1 mm. What is the minimum fluidization velocity using water at 20°C ? The beads are assumed to be spherical ($\Phi_s=1$), ϵ_M is taken as 0.40 and $\mu=0.01 \text{ P}$ and $\rho=1 \text{ g/cm}^3$. **07**

- (b) Define critical speed of the ball mill. Explain in detail the construction and working of the Ball mill with neat figure and the industrial application. **07**

OR

- Q.3** (a) What is the differential settling method? Explain in detail the working of batch sedimentation. **07**

- (b) The screen analysis shown in the following table applies to a sample of crushed quartz. The density of the particle is 2650 kg/m^3 , and the shape factors are $a=2$ and particle $\Phi_s=0.571$. For the material between 4-mesh and 200-mesh in particle size, calculate **07**

- (I) A_w in square millimeters per gram and N_w in particles per gram,
- (II) Volume mean diameter
- (III) Volume surface mean diameter
- (IV) Mass mean diameter.

Mesh	Screen opening Dpi, mm	Mass fraction retained, xi	Average particle diameter in increment, Dpi mm	Cumulative fraction smaller than Dpi
4	4.699	0	---	1
6	3.327	0.0251	4.013	0.9749
8	2.362	0.125	2.845	0.8499
10	1.651	0.3207	2.007	0.5292
14	1.168	0.257	1.410	0.2722
20	0.833	0.159	1.001	0.1132
28	0.589	0.0538	0.711	0.0594
35	0.417	0.021	0.503	0.0384
48	0.295	0.0102	0.356	0.0282
65	0.208	0.0077	0.252	0.0205
100	0.147	0.0058	0.178	0.0147
150	0.104	0.0041	0.126	0.0106
200	0.074	0.0031	0.089	0.0075
Pan	----	0.0075	0.037	0.0000

Q.4 (a) What is filter medium resistance? Explain it and derive the mathematical expression for constant pressure filtration. **07**

(b) What are the different types of conveyers? Explain in detail the screw conveyor in brief with its industrial applications. **07**

OR

Q.4 (a) Define agitation and mixing. Enlist different types of flow pattern induced in an Agitated vessel (liquid). **07**

(b) Explain in detail plate and frame filter press with its neat diagram and advantages. **07**

Q.5 (a) Discuss particle shape and size. Explain the principle of ribbon blender with its different industrial application. **07**

(b) Define minimum fluidization velocity. Describe various types of fluidization. **07**

OR

Q.5 (a) Write short notes on (1) Muller mixer (2) Pug mill. **07**

(b) What is filter medium and filter aids? Explain the mechanism of filtration in detail. **07**
