

B.E/B.TECH. Degree Examination, December 2020

Fourth Semester

**CH16403 - MECHANICAL OPERATIONS**

(Regulation 2016)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions

**PART A - (8 X 2 = 16 marks)**

1. Standard screens are used to measure the size of particles in the size range between about
  - (a) 76 mm to 38micrometer
  - (b) 76 cm to 38mm
  - (c) 7.6mm to 3.8micrometer
  - (d) 76micrometer to 38micrometer
2. Rod mills are
  - (a) Crusher
  - (b) Grinder
  - (c) Intermediate Grinder
  - (d) Ultrafine Grinder
3. In filtration compressibility coefficient value usually falls between
  - (a) 0.1 to 0.5
  - (b) 0.2 to 0.8
  - (c) 0 to 0.8
  - (d) 0.3 to 0.8
4. Setting velocity refers to
  - (a) Velocity in a direction perpendicular to the applied force.
  - (b) Velocity in a direction parallel to the applied force.
  - (c) Velocity in a direction tangent to the applied force.
  - (d) All the above
5. Distinguish between Ideal and Actual screens
6. Calculate the power required to crush 50tons/hr of limestone if 80 percent of feed passes a 50.8mm screen and 80percent of the product a 3.175mm screen? Take work index for lime stone=12.74
7. Mention any two discontinuous pressure filters used in chemical industries.
8. Give the importance of flow number in the design of baffled agitated vessels.

**PART B - (4 X16 = 64 marks)**

09. (a) The screen analysis shown below applies to a sample of crushed quartz. The density (16) of the particles is  $2650 \text{ kg/m}^3$  and the shape factor is 1.75 and  $\phi_s = 0.675$ . For the material between 4 mesh and 200 mesh in particle size, calculate  $D_s$ ,  $D_v$ ,  $D_w$  and  $N_w$ .

Mesh No.	Screen Opening $D_{p_i}$ (mm)	Cumulative mass fraction, $X_i$
4	4.699	0.0000
6	3.327	0.0251
8	2.362	0.1501
10	1.651	0.4787
14	1.168	0.7278
20	0.833	0.8868
28	0.589	0.9406
35	0.417	0.9616
48	0.295	0.9718
65	0.208	0.9795
100	0.147	0.9853
150	0.104	0.9894
200	0.074	0.9925
Pan	-	1.0000

**(OR)**

- (b) Develop a material balance equation over a screen and derive an equation for screen effectiveness. (16)
10. (a) A certain set of crushing rolls has rolls of 1000mm and 375mm width face. They (16) are set so that the crushing faces are 12.5mm apart. The manufacturer recommends their speed to be 50 to 100rpm. They employed to crush a rock having specific gravity 2.35 and the angle of nip is  $31^\circ$ . Determine the maximum permissible size of the feed and maximum actual capacity of the rolls in tonnes per hour if the actual capacity is 15% of the theoretical?
- Theoretical capacity in t/h,  $Q=4.352 \times 10^{-7} N D w d s$
- Where N in rpm., D(roll diameter) in mm, w (width) in mm, d (half the gap between the roll surface) in mm and s (specific gravity).

**(OR)**

- (b) Explain the working of Ball mill and Fluid energy mill with neat diagram, best suited for chemical process industries. **(16)**

11. (a) (i) Explain about Compressible and incompressible filter cakes **(8)**  
(ii) Discuss in detail constant pressure filtration **(8)**

**(OR)**

- (b) (i) With a neat diagram elaborate the working of continuous vacuum filter **(12)**  
(ii) List the requirements of filter media. **(4)**

12. (a) Prove that power required for agitation of Newtonian liquids can be represented by the following relationships: **(16)**

$$N_P = f(N_{Re}, N_{Fr})$$

where  $N_P$ ,  $N_{Re}$  and  $N_{Fr}$  represent dimensionless groups.

**(OR)**

- (b) (i) Explain about belt conveyor with neat diagram. **(8)**  
(ii) Discuss in detail about any one mixer used for free flowing solids with neat sketch. **(8)**