Ref .No: Ex/ChE/T/314/2019 (old)

B.E.CHEMICAL ENGINEERING THIRD YEAR FIRST SEMESTER EXAMINATION 2019(Old)

MECHANICAL OPERATIONS

Time: Three hours Full marks 100

Answer any ten questions

Assume any data missing

1. What is the ratio of mesh dimensions of two consecutive TYLER screen? What do you mean by the specific surface of a mixture of particles and open circuit and closed circuit grinding? **10**
2. Show that Effectiveness of screen E= $\frac{(X_F - X_B)(X_D - X_F)X_D.(1-X_B)}{(X_D - X_B)^2.X_F.(1-X_F)}$ using usual notations. **10**
3. Calculate the specific surface in cm^2/gm of pyrite having screen analysis given below. Sp. gravity of Pyrite is 5. **10**

Mesh	% Retained	Size (cm)
3/4	0	0.4699
4/6	8.8	0.3327
6/8	12.2	0.2362
8/10	18.0	0.1651
10/14	23.6	0.1168
14/20	19.4	0.0833
20/28	18.0	0.0589
	100.0%	

4. Rock whose average particle size 25mm is crushed to a product, whose average particle diameter is 6 mm at a rate of 10 tones/hr . At this rate the mill takes 18 kW. It requires 0.5 kW to run the mill empty. What will be the power consumption if the same feed is crushed to a particle diameter to 10 mm? Assume Rittinger's Law is valid. **10**

5. Define the term net positive suction head (NPSH) of a centrifugal pump. **2+8= 10**

   Show that head and volume flow rate is linearly proportional in case of centrifugal pump.

[Turn over

6. A pump draws a solution of specific gravity 1.84 from a storage tank of large section through 8 cm id pipe. The velocity in the suction pipe is 1.2 cm/sec. The pump discharges through 5 cm id pipe to an overhead tank. The end of the discharge line is 10m above the level of solution in the tank. Friction loss in the entire system may be taken as 2m of solution. **10**

(i)What pressure must the pump develop?

(ii)What is the horsepower required to this pumping? Assume that the pump efficiency is 65%.

7. What are the factors on which the effectiveness and capacity of screening depends? Derive an expression for the estimation of the size of the biggest particle that can be caught and crushed between a pair rolls as a function of roll sizes, roughness of the rolls and the distance between them. **10**

8. Show that $\log f_D = \log 24 - \log R_e$ when flow of solids through fluid is laminar. **10**

9. A thickener produces a thickened limestone sludge whose concentration is 550 kg/m^3 . The feed of slurry (limestone-water) to the thickener is 12.626 kg/sec. Initial slurry concentration is 236 kg/m^3. For these conditions find the thickener area taking the results of batch settling tests is as follows:- **10**

t(sec)	Interface height (m)
0	0.36
900	0.324
1800	0.286
3600	0.210
6300	0.147
10800	0.123
17100	0.116
43200	0.098
72000	0.088

10. What do you mean by term "equal Jigging'? Show that $C_0 . Z_0 = C_i . Z_i$ using Kynch theory of sedimentation. **2+8=10**

11. A certain set of crushing rolls of 40 inches diameter by 15 inches width of face. They are set so that crushing surfaces are 1 inch apart at the nearest point. The manufacturers recommended that they be run at 50 to 100 r.p.m. They are to crush a rock having a sp.gr. of 4.2 and angle of nip of 30^0. What are the permissible of feed and maximum actual capacity in tons per hour, if the actual capacity is 15% of theoretical? **10**