

Reg. No.

--	--	--	--	--	--	--	--	--	--

B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Fourth Semester

CH16403 – MECHANICAL OPERATIONS*(Chemical Engineering)***(Regulation 2016)****Time: Three Hours****Maximum : 100 Marks**Answer **ALL** questions**PART A - (10 X 2 = 20 Marks)**

	CO	RBT
1. What are the three properties of particulate solids, by which all the mechanical operations are based?	1	R
2. Calculate the sphericity of a cube of side 1 cm.	1	AP
3. List the important forces involved in size reduction of particulate solids.	2	U
4. Differentiate the salient features of Blake Jaw crusher and Dodge Jaw crusher.	2	U
5. Write the meaning of terminal settling velocity of a particle?	3	U
6. Name the industrial equipments used to separate particulate solids by its settling characteristics.	3	R
7. What is septum and give examples?	4	R
8. State the reason, why filter aids improve filtration?	4	U
9. Indicate the purpose of baffles in an agitation vessel.	4	U
10. Prove that power number is dimensionless; $N_p = P/(n^3 Da^5 \rho)$	4	AP

PART B - (5 X16 = 80 Marks)

11. (a) (i) Compare the procedure to perform the size analysis using differential analysis and cumulative analysis. (12) 1 U
- (ii) Explain the features of different standards by which the screen are built. (4) 1 U

(OR)

- (b) (i) 0.75 ton/hr of dolomite is produced by the ball mill operating in closed circuit, operating with 100 mesh screen. The screen analysis is given below. Calculate the screen efficiency. **(12) 1 AP**

Mesh No.	Feed size	Oversize	Undersize
35	7.07	13.67	0
48	16.6	32.09	0
65	14.02	27.12	0
100	11.82	20.70	2.32
150	9.07	4.35	14.32
200	7.62	2.07	13.34
-200	33.8	0	70.02

- (ii) What are real screens and how it is compared with ideal screens? **(4) 1 U**

12. (a) (i) Derive the laws of comminution from basic differential equation. **(10) 2 U**

- (ii) A material is crushed in a jaw crusher and the average size of particle is reduced from 50mm to 10mm. Consuming energy at the rate of 13kW/Kg/sec. What will be the energy needed to crush the same material of average size 75mm to an average size of 25mm? Which of the results would you record being more reliable and why? **(6) 2 AP**

(OR)

- (b) (i) Describe how mechanical and crushing efficiencies are measured. **(6) 2 U**

- (ii) Explain the construction and working principle of ball mill with neat diagram. **(10) 2 U**

13. (a) (i) A spherical particle is held motionless in water flowing upwards at a velocity of 1.2 cm/s. The particle diameter is 0.975 mm and the density is 3.5 g/cm³. Viscosity of water is 0.98 cp. When the particle is released, in what direction and what velocity will it move? **(12) 3 AP**

- (ii) Give the particle Reynolds number for different settling equation of regimes? **(4) 3 R**

(OR)

- (b) Explain with the neat sketch the principle and construction of any two industrial separator used in effluent treatment. (16) 3 U

14. (a) (i) Explain how the filtration operation is a cyclic operation. (6) 4 U
 (ii) Describe in detail the various principles of filtration operation. (10) 4 U

(OR)

- (b) A total filtrate volume of 3.37 m^3 is collected in a total time of 269.7 s. The cake is to be washed by through-washing in the plate-and-frame press using a volume of wash water equal to 10% of the filtrate volume. Calculate the time of washing and the total filter cycle time, if cleaning the filter takes 20 min. Assume $K_p = 37.93 \text{ s/m}^6$ and $B = 16.10 \text{ s/m}^3$. The filtration equation is $dt/dV_f = 4K_p V_f + B$. (16) 4 AP

15. (a) Write briefly about the various factors influenced the power consumption of Impellers in mixing tank and perform dimensionless analysis to identify their relationship. (16) 4 U

(OR)

- (b) (i) With a neat sketch describe the working of any one mixer used for compounding rubber latex. (8) 4 U
 (ii) How are pneumatic conveyors used for solids transport? (8) 4 R