A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54903

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Chemical Engineering

15UCH403 - MECHANICAL OPERATIONS

(Regulation 2015)

Duration: 3 hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Size reduction mechanism used in jaw crushers is CO1- R

   (a) Attrition (b) Compression (c) Cutting (d) Impact

2. For crushing of solids, the Rittinger's law states that the work required for crushing is proportional to CO1- U

   (a) the new surface created (b) the size reduction ratio

   (c) the change in volume due to crushing (d) none of these

3. Screen capacity is proportional to CO2- U

   (a) S (b) 1/S (c) S^2 (d) $\sqrt{S}$

4. Froth flotation is the most suitable for treating CO2- R

   (a) Iron ores (b) Sulphide ores (c) Quartzite (d) None of these

5. Flow of filtrate through the cake in a plate and frame filter press is best described by the _____ equation CO3- R

   (a) Kozney- Karman (b) Hagen- Poiseulle's (c) Fanning's (d) Kremser

6. Filtration rate does not depend upon the CO3- U

   (a) Pressure drop & area of filtering surface (b) Resistance of the cake & the septum

   (c) Properties of the cake & the filtrate (d) None of these

7. Weber number is significant and is concerned with the CO4- R

(a) Solid-liquid mixing (b) Liquid-liquid mixing

(c) Dispersion of liquid in liquid (d) Dispersion of solid in liquid

8. Consider agitation of a liquid in a baffled vessel by a turbine agitator having six flat blades. The power number for this case is practically constant for Reynolds number greater than CO4- R

(a) 1 (b) 100 (c) 1000 (d) 10000

9. Screw conveyors are CO5- R

(a) Run at very high rpm (b) Suitable for sticky material

(c) Suitable for highly abrasive material (d) All (a),(b) and (c)

10. For temporary storage before feeding solids to a process, the type of equipment used is_____ CO5- R

(a) Bin (b) Silo (c) Hopper (d) None of these

PART – B (5 x 2= 10 Marks)

11. Define kick's law. CO1- R

12. Classify various types of screen. CO2- R

13. What are the factors that controlling rate of filtration? CO3- R

14. Compare the agitation and mixing. CO4- R

15. List the different storage methods used in industry. CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) Explain the characterization of solid particles by their shape and size of the particle. CO1- U (16)

Or

(b) (i) Explain the construction and working of Jaw crusher with neat sketch. CO1- U (8)

		(ii) A material is crushed in a blake jaw crusher such that the average size of particle is reduced from 50 mm to 10 mm with the consumption of energy 13 kW(kJ/s). What would be the consumption of energy needed to crush the same material of average size of 75 mm to an average size of 25 mm: a) Assuming Rittinger's law applies? b) Assuming Kick's law applies? Which of these results would be regarded as being more reliable and why?	CO1- U	(8)
17.	(a)	(i) Derive the expression for the effectiveness of a screen. How does vary with capacity?	CO2- U	(9)
		(ii) Explain the working of vibrating screen with neat sketch.	CO2- U	(7)
		Or		
	(b)	(i) Explain the principle and working of magnetic separator with neat sketch.	CO2- U	(10)
		(ii) Discuss about froth flotation process in mineral processing industry.	CO2- U	(6)
18.	(a)	(i) Explain the construction and working of plate and frame filter press with neat sketch.	CO3- Ana	(10)
		(ii) Derive an expression for determining the specific resistance of the cake during filtration.	CO3- Ana	(6)
		Or		
	(b)	Slurry is filtered in a plate and frame press containing 12 frames, each 0.3 m square and 25 mm thick. During the first 180 s the pressure difference for filtration is slowly raised to the final value of 400kN/m^2 and during this period, the rate of filtration is maintained constant. After the initial period, filtration is carried out at constant pressure and the cakes are completely formed in a further 900 s. The cakes are then washed with a pressure difference of 275 kN/m^2 for 600 s using through washing. What is the volume of the filtrate collected per cycle and how much wash water is used?	CO3- Ana	(16)

19.	(a)	(i) Describe the construction and working of banbury mixer with neat sketch and its applications.	CO4- U	(12)
		(ii) Classify the mixers for dry powders and state their specific applications.	CO4- U	(4)
		Or		
	(b)	(i) Explain the method of calculating power required by an agitator for a given mixing.	CO4- U	(8)
		(ii) Derive an expression to estimate mixing index in case of blending granular solids.	CO4- U	(8)
20.	(a)	Discuss briefly about pneumatic conveying of solids with neat sketch.	CO5- U	(16)
		Or		
	(b)	What are various equipments used for storage of solids? Discuss any two storage equipment with neat sketch.	CO5- U	(16)