

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), MAY 2024

CHEMICAL ENGINEERING

(2020 SCHEME)

Course Code : 20CHT206

Course Name: Particle Technology

Max. Marks : 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. Define volume mean diameter.
2. Differentiate between Tyler standard screen series and Indian Standard test sieve.
3. Compare batch and continuous thickener.
4. Differentiate between mechanical and non-mechanical classifier.
5. List down the importance of size reduction.
6. Mention the advantages of ball mill.
7. List out the various characteristics of filter medium.
8. What are filter aids? List two methods of using filter aids.
9. List down two mixers for non-cohesive and cohesive solids.
10. Differentiate between screw and pneumatic conveyors.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. The given screen analysis applies to a sample of crushed quartz. The density of the particle is 2650 kg/m^3 (0.00265 g/mm^3) and the shape factor is 0.8. Calculate the following: (14)
 - a) Specific surface area (A_w) in square millimeters per gram
 - b) Volume mean diameter (D_v)
 - c) Surface mean diameter (D_s)
 - d) Mass mean diameter (D_w)
 - e) No of particles (N_i) for the 150/200 mesh increment.
 - f) What fraction of the total number of particles is in the 150/200 mesh increment?

Mesh	Screen opening D_{p_i} , mm	Mass Fraction x_i
4	4.699	0.00
6	3.327	0.0251
8	2.362	0.1250
10	1.651	0.3207
14	1.168	0.2570
20	0.833	0.1590
28	0.589	0.0538
35	0.417	0.0210
48	0.295	0.0102
65	0.208	0.0077
100	0.147	0.0058
150	0.104	0.0041
200	0.074	0.0031
Pan	-	0.0075

OR

12. a) Differentiate actual and ideal screen. List out the various standard screens. (7)
- b) Differentiate between capacity and effectiveness of a screen. Derive an expression for the screen effectiveness. (7)

MODULE II

13. a) Explain Kynch theory. Outline the procedure of a single batch sedimentation test to design a continuous thickener. (7)
- b) Explain: (7)
- i) The working of Wilfley Table.
 - ii) List any two froth floatation agents.

OR

14. a) A slurry containing 5 kg of water/kg of solids is to be thickened to a sludge containing 1.5 kg of water/kg of solids in a continuous operation. Laboratory tests using five different concentrations of the slurry yielded the following data: (7)

Concentration (kg water/kg solid)	5.0	4.2	3.7	3.1	2.5
Rate of sedimentation (mm/s)	0.20	0.12	0.094	0.070	0.050

Calculate the minimum area of a thickener required to effect the separation of a flow of 1.33 kg/s of solids.

- b) Elaborate the working principle of pneumatic classifier with a neat figure. (7)

MODULE III

15. a) A pair of rolls is to take feed equivalent to sphere 38 mm in diameter and crush them to sphere having a diameter of 12.7 mm. If the co-efficient of friction is 0.29, what should be the diameter of the rolls? (7)
- b) Explain i) Rittinger's Law (7)
ii) Bond's Law

OR

16. a) A certain crusher accepts a feed material having a volume-surface mean diameter of 19 mm and gives a product of volume-surface mean diameter of 5 mm. The power required to crush 15 tonnes per hour is 7.5 kW. What will be the power consumption if capacity is reduced to 12 tonnes per hour? (5)
- b) Explain the principle, construction and working of smooth roll crusher with a neat figure. Derive angle of nip equation for the same. (9)

MODULE IV

17. a) A filter press is used to filter a sludge forming a non-uniform compressible cake. At a constant pressure difference, 6000 L of filtrate is obtained in 1 hr. Washing is done with 1200 L of water, it proceeds exactly as filtration. The filtrate has the same properties as the wash water. Neglecting the resistance of filter cloth, calculate the washing time required. (7)

Data: Rate of washing = $\frac{1}{4}$ (final rate of filtration) for a filter press.

- b) Starting from the fundamentals, develop an expression to find filtration time required to recover a given volume of filtrate under constant pressure conditions. (7)

OR

18. a) Explain the construction and working principle of rotary drum filter with a neat figure. (7)
- b) List down the factors affecting rate of filtration. Differentiate between cake filtration and deep bed filtration. (7)

MODULE V

19. a) Explain different types of conveyors. List out the factors affecting the selection of conveyors. (9)
- b) List out the equations for mixing index for pastes. (5)

OR

20. a) Explain various mixers used for cohesive and non-cohesive solids. (9)
- b) Write a short note on Banbury mixer (5)
