B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E.   **Semester: III**
Branch: Chemical Engineering   **Duration: 3 hrs.**
Course Code: 23CH3PCMOP / 22CH3PCMOP   **Max Marks: 100**
Course: Mechanical Operations

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
  2. Missing data, if any, may be suitably assumed.

			UNIT - I	**CO**	**PO**	**Marks**
1	a)		Define Sphericity. Calculate the Sphericity of cube shaped particles.	CO1	PO1	**04**
	b)		Calculate the volume-surface mean diameter for the following particle sizes. S. No / Size range (μm) / Mass (g) table below	CO2	PO2	**08**
	c)		How do you estimate the average particle size in the mixture of particles? Write the different correlations for calculating the average particle size.	CO1	PO1	**08**
			UNIT - II			
2	a)		The particles of average feed size 2.5 mm are crushed to average product size of 0.5 mm at the rate of 15 ton/h. At this rate the crusher consumes 32 kW of power of which 2 kW are required for running the mill empty. What will be the power consumption of 10 ton/h of this product is further crushed to 0.1 mm size in the same mill? Apply Rittinger's Law.	CO3	PO3	**10**
	b)		Explain the construction and working principle of ball mill with a neat diagram.	CO3	PO3	**10**
			UNIT - III			
3	a)		Derive the expression for *Kozeny-Carman* equation and state all the assumptions.	CO2	PO2	**10**

Table for Question 1 b):

S. No	Size range (μm)	Mass (g)
1	-704 + 352	25
2	-352 + 176	37.5
3	-176 + 88	62.5
4	-88 + 44	75
5	Pan	50

				CO	PO	
	b)	How do you analyze the plot ΔP versus superficial velocity, and explain the concept of minimum fluidization velocity from the plot?		*CO2*	*PO2*	**05**
	c)	Estimate the minimum fluidization velocity of fluidized particles by water. The data of the solid particles and the fluid are given below. **Data:** D_p = 100 μm, ϕ = 1, density of particles = 2500 kg/m³, voidage of the bed = 0.4, viscosity of fluid = 0.9×10^{-3} N.s/m², density of fluid = 1000 kg/m³.		*CO2*	*PO2*	**05**
		OR				
4	a)	Describe the working of rotary drum filter with the help of neat diagram?		*CO3*	*PO3*	**10**
	b)	Derive an expression to estimate specific cake resistance and filter medium resistance for the constant pressure drop maintained during the filtration.		*CO4*	*PO4*	**10**
		UNIT - IV				
5	a)	Establish the criterion settling regime conditions for the motion of spherical particles in the fluid?		*CO4*	*PO4*	**10**
	b)	Apply criterion settling regime concept and calculate the terminal velocity at which spherical particles of galena 0.2 cm in diameter will fall in water. Data: Specific gravity of galena = 7.5 Specific gravity of water = 1.0 Viscosity of water = 0.82 cP.		*CO4*	*PO4*	**10**
		OR				
6	a)	Explain the principle of cyclone separator with the help of neat diagram.		*CO4*	*PO4*	**07**
	b)	Calculate separation factor, if the diameter of cyclone separator is 0.6 m and the inlet tangential velocity is 18 m/s.		*CO4*	*PO4*	**03**
	c)	How do you analyze the usage of thickener for industrial applications? Design the thickener area.		*CO3*	*PO3*	**10**
		UNIT - V				
7	a)	Describe the different types of impellers used in the agitators with the help of neat sketches.		*CO1*	*PO1*	**06**
	b)	How do you prevent swirling motion during mixing? Explain with the help of sketches of impeller arrangements.		*CO3*	*PO3*	**06**
	c)	Explain the principle of electrostatic separation with the help of neat diagram.		*CO3*	*PO3*	**08**

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