Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3150502 Date:21-05-2024

Subject Name: Mechanical Operations

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define (a) Mesh number (b) Screen Effectiveness (c) Statistical diameter of particle.	**03**
	(b)	Differentiate between differential analysis and cumulative	**04**
	(c)	A quartz mixture having a certain screen analysis through a standard 10 mesh screen. Calculate (a) the mass ratio of overflow and underflow to feed and (b) the effectiveness of the screen. **Data:** $D_P = D_{PC} = 1.651$ mm, $x_U = x_B = 0.195$ (mass fraction of A in underflow) (cumulative mass fraction), $x_F = 0.47$ (Mass fraction of A in feed), $x_O = x_D = 0.85$ (mass fraction of A in overflow)	**07**
Q.2	**(a)**	Differentiate between dry grinding and wet grinding.	**03**
	(b)	Calculate the sphericity of rectangular prism of dimension a x b x c for criteria a = b, c = 2a.	**04**
	(c)	Write a short note on "Vibrating screen and its importance".	**07**
		OR	
	(c)	A material is crushed in a jaw crusher and an average size of the particle reduced from 5 cm to 1 cm with the consumption of energy of 1.32×10^4 J/kg. Determine the consumption of energy to crush the same material of an average size 7.5 cm to 2.5 cm by assuming (a) Rittinger's law (b) Kick's law.	**07**
Q.3	**(a)**	Derive the expression for critical speed of a ball mill.	**03**
	(b)	The energy required per unit mass to grind limestone particles of very large size to 100 µm is 12.7 kWh/ton. Determine the estimated amount of energy to grind the particles from a very large size to 50 µm.	**04**

(c) Classify the size reduction equipment's according to their usage and give examples in each category. **07**

OR

Q.3 **(a)** Define size enlargement process and its importance. **03**

(b) Differentiate between blake jaw crusher and dodge jaw crusher. **04**

(c) Explain and differentiate open and closed circuit operation for size reduction of solid with neat schematic diagram. **07**

Q.4 **(a)** Enlist the applications of fluidization. **03**

(b) Define filter aids and their importance. **04**

(c) A tube of 0.05 m^2 cross sectional area is packed with spherical particles up to a height of 0.25 m. The porosity of the bed is 0.35. It is desired to fluidize the particles with water. Determine the minimum fluidization velocity using Ergun's equation. **07**

Data: Density = 1000 kg/m^3 and viscosity = 10^{-3} pa. sec.

Diameter of particle = 0.01 m and particle density = 2600 kg/m^3

$$\frac{\Delta P}{L} = \frac{1.75 \overline{V}_{0M}^{2} (1-\varepsilon)\rho}{\Phi_S D_P \varepsilon^3} + \frac{150 \mu \overline{V}_{0M} (1-\varepsilon)^2}{\Phi_S^2 D_P^2 \varepsilon^3}$$

OR

Q.4 **(a)** Define cake resistance and filter medium resistance. **03**

(b) Define pneumatic conveying and its applications. **04**

(c) With neat and clean diagram explain, Batch sedimentation process in detail. **07**

Q.5 **(a)** Enlist the various types of propellers. **03**

(b) Write a short note on washing of filter cakes. **04**

(c) Explain in detail with neat and clean diagram. "Basket centrifuge" **07**

OR

Q.5 **(a)** Define, "Power number and its significance" **03**

(b) Discuss the important features of cyclone separator. **04**

(c) Discuss in detail. "Classification of turbine" **07**

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