Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2023

Subject Code:3150505 Date:11-12-2023

Subject Name: Particle and Fluid Particle Processing

Time:10:30 AM TO 01:00 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.**

Q.1	**(a)**	Differentiate: Particulate fluidization and Bubbling fluidization	**03**
	(b)	Explain in brief: Heating and cooling mixers	**04**
	(c)	Define sorting classifiers. Explain the 'sink and float' method for sorting classifiers.	**07**
Q.2	**(a)**	Classify solid-fluid operations.	**03**
	(b)	Explain Tray drier for solids in brief.	**04**
	(c)	Explain with a neat sketch the construction and working of rotary drum vacuum filter and enlist its advantages and limitations.	**07**
		OR	
	(c)	A sludge filtered in a washing plate and frame press is of such a nature that the filtration equation is $V^2 = Kt$, where V is the volume of the filtrate obtained in time t; when the pressure is constant, 40 cubic meters of filtrate is produced in 10 hrs. (i) 4 cubic meters of wash water is forced through the cake at the end of the filtration. What is the washing time? (ii) If the filtering surface of the press is doubled, all other conditions remain constant; how long does it take to produce 40 cubic meters of filtrate?	**07**
Q.3	**(a)**	Differentiate: Homogeneous nucleation and heterogeneous nucleation	**03**
	(b)	Explain various solid-fluid operations with suitable examples in brief.	**04**
	(c)	Explain the fluid flow in porous solid beds and derive the Kozeny-Carman equation.	**07**
		OR	
Q.3	**(a)**	Discuss in brief: Growth of crystals	**03**
	(b)	Explain the terms: (i) screen capacity (ii) screen effectiveness	**04**
	(c)	Explain slurry and pneumatic transport systems in detail.	**07**
Q.4	**(a)**	Explain the terms mixing and agitation with examples.	**03**
	(b)	Explain the terms: (i) Fluidization (ii) Minimum fluidization velocity	**04**
	(c)	A certain set of crushing rolls of 150 cm in diameter by 50 cm width face. They are set so that the crushing surfaces are 1.25 cm apart at the narrowest point. The manufacturer recommends 100 rpm as the roll speed. They are to crush a rock having a specific gravity of 2.35 and an angle of nip is 30°. (i) What are the maximum permissible size of feed and the maximum actual capacity in metric tons per hour if the actual capacity is 12 % of the theoretical? (ii) After long use, the tires on the rolls of the mill have become roughened so that the angle of nip is 32°30'. What will now be the maximum permissible size of feed and the capacity of the rolls?	**07**
		OR	

Q.4	**(a)**	Explain in brief: Static Mixers	**03**
	(b)	Discuss various applications of fluidization.	**04**
	(c)	A disc turbine with six flat blades is installed centrally in a vertical baffled tank 1.83 m in diameter. The turbine is 0.61 m in diameter and is positioned 0.61 m above the bottom of the tank. The turbine blades are 127 mm wide. The tank is filled to a depth of 1.83 m with an aqueous solution of 50 percent NaOH at 65.6°C, which has a viscosity of 12 cP and a density of 1498 kg/m^3. The turbine impeller turns at 90 r/min. What power will be required to operate the mixer? If N_{Re} < 10,000 take N_P =5.6, and N_{Re} > 10,000 take N_P= 5.8	**07**
Q.5	**(a)**	Explain in brief: Vibrating screen	**03**
	(b)	Define the separation factor for the cyclone separator. List out factors affecting the performance of the cyclone separator.	**04**
	(c)	Explain construction and working of the Bollman extractor for leaching operation in detail.	**07**

OR

Q.5	**(a)**	Explain the screw conveyor in brief.	**03**
	(b)	Explain in brief: Calculation of power required for agitation	**04**
	(c)	Explain the Slurry bed reactor in detail.	**07**

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