Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:3150502 Date:17-05-2025

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: (1) Screen Effectiveness (2) Screen Capacity (3) Work Index	**03**
	(b)	Calculate the Sphericity of Rasching Ring of Dimensions $L=D_0$ and $Di=0.5D_0$	**04**
	(c)	Describe various laws for size reduction and write principle of comminution.	**07**
Q.2	**(a)**	Differentiate between constant rate filtration and constant pressure filtration.	**03**
	(b)	Explain sink and float method.	**04**
	(c)	Explain construction and working of continuous rotary vacuum filter.	**07**
		OR	
	(c)	A material is crushed in a jaw crusher and the average size of the particle is reduced from 5 cm to 1 cm with consumption of energy at the rate of $1.32*10^4$ J/kg. What will be the consumption of energy necessary to crush the same material of average size 7.5 cm to an average size 2.5 cm? The mechanical efficiency remains same. (a) Using Rittinger's law; (b) using Kick's law	**07**
Q.3	**(a)**	Define: (i) angle of nip and (ii) mixing index (iii) mesh number.	**03**
	(b)	Explain: “For efficient grinding, ball mills must be operated at a speed less than the critical speed.”	**04**
	(c)	Draw neat sketch of an agitated vessel and label the important parts. What are the various methods for prevention of swirling in an agitated vessel?	**07**
		OR	
Q.3	**(a)**	Give the difference between ideal screen and actual screen.	**03**
	(b)	A set of crushing rolls of 1000 mm diameter by 375 mm width of face. Minimum spacing between two rolls is 12 mm and the angle of nip is 30. What is the maximum permissible size of feed?	**04**
	(c)	Describe batch sedimentation process with a graph. Describe a continuous gravity thickener.	**07**
Q.4	**(a)**	What is power number and its significance?	**03**
	(b)	Write short note on storage in bin and silos.	**04**
	(c)	In a filter press, at a constant pressure difference of 3.0 kg/cm^2 , a 12cm cake is formed in one hour with a filtrate volume of 5400 liters. Washing proceeds exactly as filtration using 900 liters. All other operation takes 11 minutes time.	**07**

Assume the filtrate has same properties of wash water. The rate of washing is 0.20 times the final filtration rate. Calculate the volume of filtrate produced in one day of operation.

OR

Q.4	**(a)**	Discuss about continuous fluidization.	**03**
	(b)	With neat diagram explain about Tromells.	**04**
	(c)	Explain characteristics, selection criteria and applications of paddles.	**07**
Q.5	**(a)**	What rotational speed in RPM would you recommend for a ball mill 1200 mm in diameter charged with 75 mm balls?	**03**
	(b)	Differentiate between clarifier and classifiers.	**04**
	(c)	With neat sketch, explain pneumatic conveying system with advantages and disadvantages.	**07**

OR

Q.5	**(a)**	Explain about electrostatic separation.	**03**
	(b)	Write short note on batch centrifuge.	**04**
	(c)	What are the different types of conveyers? Explain in detail the screw conveyer with its industrial applications.	**07**

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