Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fourth Semester – Regular/Supplementary) Examinations, April 2026

23BCHPC24003 - Mechanical Operations

(Chemical Engineering)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	Find out the Rittengers Constant from the following date Feed Size =50×10^{-4} m, Product size =10×10^{-4} m, Rate =20 ton/hr, Power consumption= 35 KW.	CO2	K1
b.	A pair of rolls is to take a feed equivalent to spheres of 38mm in diameter and crush them to spheres having 12.7mm diameter. If the coefficient of friction is 0.29, what would be the diameter of rolls?	CO3	K2
c.	Identify the key parameters that affect the performance of a screening operation.	CO4	K1
d.	Distinguish between hydrophobic and hydrophilic substances with suitable examples.	CO5	K1
e.	Describe the phenomenon of hindered settling and its significance in separation processes.	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

	Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a.	Define comminution and discuss its significance in industrial operations. Examine the objectives and fundamental laws governing size reduction, and explain their influence on equipment choice and process performance.	5	CO1	K1
b.	Derive an expression for energy requirement in size reduction considering crushing efficiency and mechanical efficiency, and discuss its practical implications.	5	CO1	K1
	(OR)			
c.	Explain the construction, working principle, and operation of a Blake jaw crusher with a neat diagram.	5	CO1	K1
d.	Derive the expression for the critical speed of a ball mill and explain its significance in operation.	5	CO1	K2
3.a.	Derive the relationship between feed, overflow, and underflow compositions in a screening process, and hence obtain an expression for screening effectiveness.	5	CO2	K1
b.	A screening operation gives the following data: feed contains 30% coarse particles, overflow contains 80% coarse particles, and underflow contains 10% coarse particles. Determine the screen effectiveness.	5	CO2	K2
	(OR)			
c.	Derive expressions for recovery and rejection in screening and explain how these parameters are used to evaluate screen performance.	5	CO2	K1
d.	Explain the working principle, construction, and applications of the following industrial screening equipment:Trommel screen .Compare their advantages and limitations.	5	CO3	K1

4.a.	Define froth flotation as used in mineral processing. Describe its operating principle in detail and explain how it is applied for the separation of sulphide ores from gangue materials.	5	CO3	K1
b.	Explain the principle, construction, working, and applications of a magnetic separator. Discuss its advantages and limitations.	5	CO3	K1
	(OR)			
c.	What is jigging in mineral processing? Explain the working principle of jigging in detail. How is jigging applied in the separation of ore particles based on density?	5	CO3	K1
d.	Describe the mechanism of separation in a Wilfley table and the role of differential motion.	5	CO4	K1
5.a.	Describe the mechanism of sludge thickening and its importance in wastewater treatment.	5	CO4	K1
b.	A sample of bauxite ore is to be cleaned using water in a clarifier. The ore particle has size ranges of 10 to 500 micron. The mixture is being separated into three fraction pure bauxite, pure silica and third fraction is the middling. Estimate the size range of the three fraction assuming the flow is laminar .specific gravity of Bauxite is 2.2 and Silica 2.8.	5	CO4	K3
	(OR)			
c.	Explain the working of a batch sedimentation process with a neat sketch.	5	CO5	K1
d.	Define drag coefficient. Derive the terminal velocity of a spherical particle moving through a fluid in stokes law region.	5	CO5	K1
6.a.	Define the rate of filtration and explain the key factors that influence it. Derive an expression for the rate of filtration in a continuous filtration process. Analyse how parameters like pressure drop, filter medium, and cake resistance affect filtration efficiency.	5	CO5	K2
b.	Explain the working principle of a vacuum filter. Include a diagram to support your explanation and describe its applications in various industries.	5	CO5	K1
	(OR)			
c.	Explain the working principle of a cyclone separator. Analyse the factors influencing its collection efficiency and derive an expression for it. Illustrate your answer with a diagram and evaluate the performance of cyclone separators in different industrial applications.	5	CO6	K1
d.	Explain the classification of mixing equipment for solids, liquids, and semi-solids with suitable examples.	5	CO6	K2

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