QP Code: RA23BTECH126 Reg. No | | | | | | | | | | | AY 23

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech(Fourth Semester - Regular) Examinations, April – 2025

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. Express the ways to represent the shape of particle.	CO2	K1
b. What should be the diameter of rolls to take the feed of 0.04mand crush to 0.01m.Take coefficient of friction 0.35?	CO2	K1
c. Prioritize why in some cases filter aid is added before filtration.	CO1	K2
d. Analyse the principle of Jigging for separation of solid-solid.	CO2	K1
e. Express the ways to represent the size of an irregular particle	CO2	K1

PART – B **(10 x 5=50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Define particle size and shape. Explain the importance of particle size and shape in industrial processes. Describe various methods used to determine particle size and shape. Analyze how these characteristics influence process performance and product quality	5	CO1	K1
b. Explain the working principle, construction, and operational features of a Blake Jaw crusher as size reduction equipment.	5	CO2	K2
(OR)			
c. Explain the concept of energy and power consumption in size reduction equipment. Derive and compare the different laws of size reduction—Rittinger's Law, Kick's Law, and Bond's Law—highlighting their assumptions and applications.	6	CO1	K1
d. Analyze how these laws help in estimating energy requirements in various size reduction processes.	4	CO2	K2
3.a. What is screening and why is it important in industries and the environment? How does screening work, what factors affect its efficiency, and what are the different types of screens?	5	CO2	K2
b. Define screen efficiency and explain its importance in particle separation. Derive the expression for screen efficiency and analyze the factors that affect it.	5	CO2	K1
(OR)			
c. An sponge-iron industry uses a reciprocating screen of 5 mm aperture size to separate the undersize from mixture which is coming from a furnace. The Screen analysis of furnace output founds to contain 25% fines. The efficiency of Screen is 50%. The underflow from the screen contains 95% fines. If the furnace output rate is 100 tons/hour, find the product rate and amount of fines present in it.	7	CO2	K2

d.	A sand mixture was screened through a standard 12 mesh screen. The mass fraction of the oversize material in feed, overflow and underflow were found to be 0.4, 0.8 and 0.2 respectively. Calculate the screen effectiveness.	3	CO3	K3
4.a.	Define the drag coefficient. Derive expressions for terminal settling velocity of a particle settling through a fluid using Stokes's Law and Newton's Law. Clearly state all the assumptions made in each case.	7	CO3	K2
b.	Calculate the maximum velocity at which a spherical particle of galena 0.15 cm in diameter will fall in water Data: Specific Gravity of Galena : 7.5 Specific Gravity of Water : 1.0 ,Viscosity of water: 0.0082 poise, Drag Coefficient: 0.45	3	CO4	K3
	(OR)			
c.	A sample of bauxite ore is to be cleaned using water in a classifier. The ore particle has a size ranges of 10 to 500 micron. The mixture is being separated into three part: Pure bauxite (Specific Gravity: 2.2), Pure silica (Specific Gravity: 2.8) and the third fraction is the middling which is recycled. Estimate the size ranges of the three fraction assuming the flow is laminar .	5	CO3	K1
d.	What is a thickener? Explain its working and importance in solid-liquid separation. What factors affect its performance, and where is it used.	5	CO4	K2
5.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. Analyze how parameters like pressure drop, filter medium, and cake resistance affect filtration efficiency.	5	CO4	K3
b.	Explain the working principle of a Pressure filter. Include a diagram to support your explanation and describe its applications in various industries.	5	CO3	K2
	(OR)			
c.	Explain the principle and working of the froth flotation process. Discuss the role of reagents used and the factors affecting flotation efficiency.	5	CO4	K2
d.	Illustrate the process with a neat diagram and mention its industrial applications.	5	CO4	K3
6.a.	Define mixing and agitation. Differentiate between solid mixing and liquid mixing based on their mechanisms and applications.	5	CO1	K2
b.	Analyze the factors that affect mixing efficiency in both cases, and evaluate suitable mixing equipment for different industrial processes.	5	CO2	K2
	(OR)			
c.	Describe different types of storage equipment used and analyze the factors affecting flow behaviour, such as particle size, moisture content, and hopper design.	5	CO1	K3
d.	Evaluate common flow problems like arching and rat-holing, and suggest methods to overcome them.	5	CO2	K3

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