

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)**

**CLASS: BTECH
BRANCH: CHEMICAL ENGG./FOOD TECH.**

**SEMESTER : IV
SESSION : SP/2025**

SUBJECT: CL205R1 MECHANICAL OPERATIONS

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

		CO	BL
Q.1(a) Estimate power required to crush limestone of feed dia 51mm and size reduced particle dia of 3.2 mm in a dry grind process, if feed mass flow rate is 100 ton/hr and work index is 12.74 for wet grinding.	[2]	1	5
Q.1(b) Illustrate rod mill with a neat figure with part labels and list the disadvantages of it.	[3]	3	2
Q.2(a) Identify and name the machines linked with the following terms: (i) coconut shell plants (ii) conical crushing head (iii) in-built screen (iv) pigments & dyes (v) primary size reduction (vi) grinding vitamins	[2]	2	4
Q.2(b) Evaluate grinding rate function of a milling operation, if time taken to reduce an initial mass fraction of 0.0251 to diminish by 15% is 105.3 s. Also, compare $\Delta B_{n,u}$ and $B_{n,u}$	[3]	1	5
Q.3(a) Analyze and explain the principle of operation of a fluid energy mill pictorially using a diagram and also explain opposite forces working inside a ball mill with mathematical formulae	[3]	3	4
Q.3(b) Calculate sphericity of a short cube assume $L=D$	[2]	2	2
Q.4(a) Define angle of repose. How do you determine Pressure at the base of a vertical bin filled with particulate solids by Janssen Equation	[3]	1	2
Q.4(b) Size analysis was carried out on a sample of gravel. The data of mass fraction (x_i) and average particle diameter D_{pi} of the fraction is given in table.	[2]	3	4

(x_i)	D_{pi} (mm)
0.2	5
0.3	10
0.3	20
0.2	25

Calculate the mass mean diameter of the sample

Q.5(a) Mention the criterion required for selection of conveying system of particles. Explain the principle of belt conveyer.	[3]	2	3
Q.5(b) Write the different types of flow observed through bin. Explain with diagram.	[2]	3	4

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