

Model Question Paper-1/2 with effect from 2022-23 (CBCS Scheme)

USN

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fourth Semester B.E. Degree Examination MECHANICAL OPERATIONS

TIME: 03 Hours

Max. Marks: 100

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1												*Bloom's Taxonomy Level	Marks	
Q.01	a	Define the following: a) Particle shape b) Particle size c) shape factor d) Sphericity,												L1	8	
	b	Differentiate between Ideal and actual screen												L2	6	
	c	With a neat sketch explain the construction and working of the following a) Gyrotory screen b) Vibrating screen												L2	6	
OR																
Q.02	a	Briefly explain the differential and cumulative method of screen analysis												L2	6	
	b	For the screen analysis give below; find out volume surface mean diameter, specific surface area and mass mean diameter.												L3	14	
		Size of opening (mm)	4.7	3.3	2.4	1.6	1.17	0.83	0.59	0.42	0.3	0.21	0.15	0.1		
		Mass retained (gms)	0	3.1	10.3	20	18.6	15.2	12	9.5	6.5	0.43	0.5	0		
		Data : Sphericity (ϕ_s)=0.7, Shape Factor(τ)=2, $\rho_p = 0.0025 \text{ gm/mm}^3$														
Module-2																
Q. 03	a	State and explain the laws of comminution and work index												L2	8	
	b	Derive an equation for critical speed of a ball mill												L2	6	
	c	Find out the critical speed of the ball mill by using the following data : Diameter of ball mill = 450 mm Diameter of ball = 25 mm												L3	6	
OR																
Q.04	a	With a neat sketch explain the construction and working of the following a) Blake jaw crusher b) Ball mill												L2	12	
	b	A certain crusher accepts a feed material having a volume-surface mean diameter of 19 mm and gives a product of volume-surface mean diameter of 5 mm. The power required to crush 15 tonnes per hour is 7.5 kW. What will be the power consumption if the capacity is reduced to 12 tonnes per hour?												L3	8	
Module-3																
Q. 05	a	Derive the equation for one dimensional motion of particle through fluid in gravitational field												L2	10	
	b	What is terminal settling velocity? Derive the expression for terminal settling velocity for a spherical particle settling freely under gravity at low Reynolds number												L2	10	
OR																
Q. 06	a	What is fluidization? Explain the types of fluidization. Derive an equation for minimum fluidization velocity.												L2	10	
	b	Define Drag, Drag coefficient. Derive Ergun's equations stating all assumptions												L2	10	
Module-4																
Q. 07	a	Explain with neat sketches the batch sedimentation test and its various zones												L2	8	
	b	A single batch settling test was made on liquid slurry. The interface between clear												L3	12	

		liquid and suspension solid were observed as a function of time and the results are tabulated below. The test was made using 236 g of lime stone per liter of liquid. Calculate the thickener area, if the slurry is fed at a rate of 50000 kgs dry solids per hour to produce thickened sludge of 550 g lime stone per liter.																				
		<table border="1"> <tr> <td>Time(hr):</td> <td>0</td> <td>0.25</td> <td>0.5</td> <td>1.0</td> <td>1.75</td> <td>3.0</td> <td>4.75</td> <td>12.0</td> </tr> <tr> <td>Height of Interface (cm):</td> <td>36.0</td> <td>.24</td> <td>28.6</td> <td>21.0</td> <td>14.7</td> <td>12.3</td> <td>11.55</td> <td>9.8</td> </tr> </table>	Time(hr):	0	0.25	0.5	1.0	1.75	3.0	4.75	12.0	Height of Interface (cm):	36.0	.24	28.6	21.0	14.7	12.3	11.55	9.8		
Time(hr):	0	0.25	0.5	1.0	1.75	3.0	4.75	12.0														
Height of Interface (cm):	36.0	.24	28.6	21.0	14.7	12.3	11.55	9.8														
OR																						
Q. 08	a	With a neat sketch explain the following: a) Sand filter b) Rotary drum filter	L2	10																		
	b	For a sludge filtered in a washing plate and frame the filtration equation $V^2 = Kt$ holds good, where V is the volume of the filtrate obtained in time t. When the pressure is constant, 30 m ³ of filtrate is obtained in 10 h. (i) Calculate the washing time if 3 m ³ of wash water is forced to the cake at the end of filtration. (ii) If the filtering area/surface is doubled keeping all other things constant, how long would it take to obtain 30 m ³ of filtrate ?	L3	10																		
Module-5																						
Q. 09	a	.With a neat sketch explain the construction and working of the following a) Muller mixers b) Ribbon blender	L2	10																		
	b	Write a note on the following a) Open and closed storage b) Bulk and bin storage	L2	10																		
OR																						
Q. 10	a	Write a note on a) Belt conveyers, b) Chain conveyor, c) Apron conveyor, d) Bucket conveyor,e) Screw conveyor.	L2	10																		
	b	With a neat sketch explain the construction and working of the following a) Magnetic separator b) Electrostatic separator	L2	10																		

*Bloom’s Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.