

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: F1+TF1

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST – II
FALL SEMESTER 2024-2025

Programme Name & Branch : B.Tech; Chemical Engineering
Course Code : BCHE301L
Course Name : Mechanical Operations
Faculty Name(s) : Dr. Aabid Hussain Shaik
Class Number(s) : VL2024250102957
Exam Duration : 90 minutes **Maximum Marks: 50**

General instruction(s):

- Answer all the questions
- Assume any missing data if necessary

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)																		
1.	A conventional cyclone with a diameter of 1.0 m and width 0.25 m is to be used to separate particulate matter of density 1500 kg/m³ from standard air at a flow rate of 2 m³/s. An analysis of the particles yielded the following size distribution. Consider viscosity of air as 18.6 μPa.s and effective number of turns within cyclone as 6. Calculate the overall separation efficiency. <table><tr><td>Size, μm</td><td>3.0</td><td>6.0</td><td>10.0</td><td>20.0</td><td>40.0</td><td>80.0</td><td>140.0</td><td>200.0</td></tr><tr><td>Weight fraction</td><td>0.03</td><td>0.08</td><td>0.15</td><td>0.33</td><td>0.60</td><td>0.85</td><td>0.96</td><td>0.99</td></tr></table>	Size, μm	3.0	6.0	10.0	20.0	40.0	80.0	140.0	200.0	Weight fraction	0.03	0.08	0.15	0.33	0.60	0.85	0.96	0.99	10	3	3
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2.	An analysis was made for flue gas released from a chemical process industry. It shows that flue gas contains the following compounds: particulate matter of 25 μm to 50 μm, oxides of sulphur, nitrogen, carbon and a trace amount of hydrocarbons. Being a Chemical Engineer, suggest a suitable equipment to remove the contaminants from the flue gas and explain their principles with neat sketches.	10	3	3																		
3.	In a mixture of quartz (specific gravity = 2.65) and galena (specific gravity = 7.5), the size of the particles range from 0.00052 cm to 0.0025 cm. On separation in a hydraulic classifier with water as medium, under free settling streamline conditions, three fractions are obtained: one consisting of only quartz, one of	10	4	3																		



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	only galena and one a mixture of quartz and galena. Estimate the ranges of particle sizes of the two substances in the mixed portion.																					
4.	A suspension of uniform particles in water at a concentration of 500 kg of solids per cubic meter of slurry is settling in a tank. Density of the particles is 2500 kg/m ³ and terminal velocity of single particle is 20 cm/s. Estimate the hindered settling velocity of the suspension. Assume Richardson-Zaki hindered settling index as 4.6.	10	4	3																		
5.	A slurry consists of 3% by weight of solids (specific gravity = 2.5) is to be clarified by continuous sedimentation. Feed to the clarifier is 5000 m ³ /day and the area of the thickener is 200 m ² . The underflow contains 15% solids. Design the height of a thickener. The batch sedimentation data is as follows: <table><tr><td>t (min)</td><td>0</td><td>5</td><td>12</td><td>24</td><td>40</td><td>70</td><td>250</td><td>infinity</td></tr><tr><td>H (cm)</td><td>40</td><td>25</td><td>15</td><td>8</td><td>5</td><td>3</td><td>1.8</td><td>1.7</td></tr></table>	t (min)	0	5	12	24	40	70	250	infinity	H (cm)	40	25	15	8	5	3	1.8	1.7	10	4	4
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