SLOT: G1+TG1

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

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST (CAT) -I
FALL SEMESTER 2026-2027

Programme Name & Branch : B. Tech & BCM
Course Code : BACHE305
Course Name : Mechanical Operations
Faculty Name(s) : Dr. Mohammed Rehaan Chandan
Class Number(s) : VL2026270101036
Date of Examination : 16th August 2026
Exam Duration : 90 minutes **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes Statements:

CO. 1: Characterize particulate solids based on properties such as particle shape, size, and mixture types, and understand the principles of various screening and conveying methods.
CO. 2: Explain and apply the principles of size reduction for different materials, including the operation and selection of various comminution equipment.

<table>
<tr><th>Q. No</th><th>Question</th><th>M</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>a. Calculate the sphericity of a cylinder having its height five times its diameter. (5 marks)
b. Discuss in detail about the different mechanisms behind particle agglomeration. (5 marks)</td><td>10</td><td>CO1</td><td>L2</td></tr>
<tr><td>2.</td><td>a. Explain the working principle of an air slide conveyor using various types of mechanism with a neat diagram. (5 marks)
b. What are the various types of standard screens, and by what methods can their efficiency be optimized? (5 marks)</td><td>10</td><td>CO1</td><td>L2</td></tr>
<tr><td>3.</td><td>As an engineer you have been asked to determine the screening efficiency of the 10 mm screen. The feed, oversize and undersize samples were taken and sized with the following data generated.
a. Conduct size analysis of each product to represent the data.
b. Determine the effectiveness of the 10 mm screen and the mass ratio of overflow and underflow to feed.
<table>
<tr><th>Aperture (mm)</th><th>Feed Mass (kg)</th><th>Oversize Mass (kg)</th><th>Undersize Mass (kg)</th></tr>
<tr><td>40</td><td>8</td><td>15</td><td>0</td></tr>
<tr><td>28</td><td>25</td><td>25</td><td>0</td></tr>
<tr><td>20</td><td>120</td><td>95</td><td>2</td></tr>
<tr><td>14</td><td>242</td><td>170</td><td>10</td></tr>
<tr><td>10</td><td>370</td><td>290</td><td>30</td></tr>
<tr><td>7</td><td>180</td><td>55</td><td>120</td></tr>
<tr><td>5</td><td>155</td><td>30</td><td>138</td></tr>
<tr><td>3.5</td><td>160</td><td>10</td><td>150</td></tr>
<tr><td>2.5</td><td>120</td><td>8</td><td>120</td></tr>
<tr><td>1.8</td><td>90</td><td>1</td><td>100</td></tr>
<tr><td>-1.8</td><td>30</td><td>1</td><td>30</td></tr>
</table></td><td>10</td><td>CO1</td><td>L3</td></tr>
</table>

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4.	A material is crushed in a Blake Jaw crusher and the average size of particles is reduced from 5 cm to 1.3 cm, with consumption of energy at the rate of 37 kW/(kg.s). What will be the consumption of energy necessary to crush the same material of average size 8 cm to an average size of 3 cm? The mechanical efficiency remains unchanged. (i) Using Rittinger's law (ii) Using Kick's law.	10	CO2	L3
5.	A certain set of crushing rolls has rolls of 150 cm in diameter by 50 cm width of face. They are set so that the crushing surfaces are 1.25 cm apart at the narrowest point. The manufacturer recommends 100 rpm., as the roll speed. They are to crush a rock having a specific gravity of 2.35 and the angle of nip is 30°. (a) What are the maximum permissible size of feed and the maximum actual capacity in metric tons per hour if the actual capacity is 12% of theoretical? (b) After long use, the tires on the rolls of the mill have become roughened so that the angle of nip is 33.5°. What will now be the maximum permissible size of feed and the capacity of the rolls?	10	CO2	L3

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