REG.NO.:

VIT

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

SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST -I
FALL SEMESTER 2025-2026

SLOT: C2+TC2

Programme Name & Branch	: B. Tech (Chemical Engineering)
Course Code	: BCHE201L
Course Name	: Computational Methods in Chemical Engineering
Faculty Name(s)	: Dr. Monash P. /Dr. Anand VP Gurumoorthy
Faculty Emp ID	: 14831/13332
Class Number(s)	: VL2025260101225/VL2025260101221
Date of Examination	: 19-08-2025
Exam Duration	: 90 minutes

Maximum Marks: 50

General instruction(s):

- Assume data wherever necessary
- Use four decimal places of accuracy, unless otherwise stated.

Q. No	Question	Marks	CO	BL
1.	The following equation pertains to the concentration of a chemical in a completely mixed reactor $c = c_{in}\,(1-e^{-0.04t}) + c_0 e^{-0.04t}$ If the initial concentration $C_0 = 4$ and the inflow concentration $C_{in} = 10$, apply any one bracketing method to determine the time required for the 'C' to be 90 percent of C_{in}. The process engineer says it will take 25 to 50 min based on her experience. Stopping criterion of 0.1%.	10	1	3
2.	Chlorine gas (1 mole) is at 370 K and 20 atm. The volume of the gas is determined using Van der Waals equation by an engineer. $\left(P+\frac{a}{v^2}\right)(v-b)=RT$ The engineer took the volume of 1.5 L and 2.5L as initial guesses. Apply Secant method to determine the volume of the gas. Data: Van der Waals constants for chlorine gas: $a = 6.49\ L^2.atm/mol$; $b = 0.0562$ L/mol. $R = 0.08206$ L atm/mol K. Specified error, $\varepsilon_s = 0.1\%$. As a budding chemical engineer comment on the guess made by the engineer?	10	1	3

<table>
<tr><th>Q. No</th><th>Question</th><th>Marks</th><th>CO</th><th>BL</th></tr>
<tr><td>3.</td><td>An electrical engineer supervises the production of three types of electrical components. Three kinds of material (metal, plastic, and rubber) are required for production. The amounts needed to produce each component are given in the table.
<table>
<tr><th>Component</th><th>Metal (g/component)</th><th>Plastic (g/component)</th><th>Rubber (g/component)</th></tr>
<tr><td>1</td><td>15</td><td>0.30</td><td>1.0</td></tr>
<tr><td>2</td><td>17</td><td>0.40</td><td>1.2</td></tr>
<tr><td>3</td><td>19</td><td>0.55</td><td>1.5</td></tr>
</table>
Apply Gauss Elimination method to compute the number of each component that can be produced, if a total of 3175, 79, and 232 g of metal, plastic, and rubber, respectively, are available each day.</td><td>10</td><td>2</td><td>3</td></tr>
<tr><td>4.</td><td>A civil engineer involved in construction requires 4800 m^3, 5810 m^3 and 5690 m^3 of sand, fine gravel, and coarse gravel, respectively, for a building project. These materials can be obtained from three pits. The composition of these pits is given below.
<table>
<tr><th></th><th>Sand (%)</th><th>Fine Gravel (%)</th><th>Coarse Gravel (%)</th></tr>
<tr><td>Pit 1</td><td>45</td><td>20</td><td>20</td></tr>
<tr><td>Pit 2</td><td>25</td><td>50</td><td>15</td></tr>
<tr><td>Pit 3</td><td>30</td><td>30</td><td>65</td></tr>
</table>
Determine the cubic meters of sand, fine gravel and coarse gravel that must be hauled from each pit in order to meet the engineer's needs using Gauss-Seidel method. Take initial guess as ones and the stopping criterion, ε_s, = 0.1%.</td><td>10</td><td>2</td><td>3</td></tr>
<tr><td>5.</td><td>The following table gives pressure of steam at a given temperature.
<table>
<tr><td>Temperature, °C</td><td>140</td><td>150</td><td>160</td><td>170</td><td>180</td></tr>
<tr><td>Pressure, bar</td><td>3.685</td><td>4.854</td><td>6.302</td><td>8.076</td><td>10.225</td></tr>
</table>
Apply Newton's interpolating polynomial of order 3 to determine the pressure for a temperature of 168 °C.</td><td>10</td><td>3</td><td>3</td></tr>
</table>

****