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: D1+TD1

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)	: VL2025260101219/VL2025260101223
Date of Examination	: 20-08-2025
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 concentration of pollutant bacteria 'c' in a lake decreases according to the following equation. $c = 70e^{-1.5t} + 25e^{-0.075t}$ Apply any one bracketing method to determine the time required for the bacteria concentration to be reduced to 8. The pollution control engineer says it will take 10 to 20 min based on his experience. Stopping criterion, $\varepsilon_s = 0.1\%$.	10	1	3
2.	Methane gas (1 mole) is at 500 K and 1 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 an initial guess volume of 32 L. Apply Newton-Raphson method to determine the volume of the gas. Data: Van der Waals constants for methane gas: a = 2.273 L^2.atm/mol; b = 0.0428 L/mol. R = 0.08206 L atm/mol K. Specified error, $\varepsilon_s = 0.2\%$. As a budding chemical engineer comment on the guess made by the engineer?	10	1	3

Q. No	Question	Marks	CO	BL
3.	A liquid-liquid extraction process conducted in the electrochemical materials laboratory involved the extraction of nickel from the aqueous phase into an organic phase. A typical set of experimental data from the laboratory is given below.	10	2	3

Ni aqueous phase, a (g/L)	2	2.5	3
Ni organic phase, g (g/L)	7	10	12

Assuming 'g' is the amount of Ni in the organic phase and 'a' is the amount of Ni in the aqueous phase, the quadratic interpolant that estimates 'g' is given by

$$g = x_1 a^2 + x_2 a + x_3; \qquad 2 \le a \le 3$$

Apply naïve Gauss elimination method to determine the polynomial coefficients x_1, x_2, and x_3.

Q. No	Question	Marks	CO	BL
4.	An electronics company produces transistors, resistors, and computer chips. The material requirement for each component is given in the following Table.	10	2	3

Component	Copper	Zinc	Glass
Transistors	4	1	2
Resistors	3	3	1
Computer chips	2	1	3

The total amounts of materials available are 960 units of copper, 510 units of zinc, and 610 units of glass. Apply Gauss-Seidel method to determine the number of transistors, resistors and computer chips to be manufactured this week. Stopping criterion $\varepsilon_s = 0.5\%$. Take initial guesses as 100 for all the variables. i.e. 100 units of each component.

Q. No	Question	Marks	CO	BL
5.	The following data define the sea-level concentration of dissolved oxygen (O) for fresh water as a function of temperature (T).	10	3	3

T, (°C)	0	8	16	24	32
O, (mg/L)	14.6256	11.8421	9.8762	8.4236	7.3145

Apply Newton's interpolating polynomial of order 3 to determine the concentration of dissolved oxygen at the temperature 27°C.

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