



SCHOOL OF CHEMICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST (CAT) -II
WINTER SEMESTER 2025-2026

Programme Name & Branch : B.Tech & Chemical Engineering
Course Code : BCHE406L
Course Name : AI in Chemical Engineering
Faculty Name(s) : Dr. Bandaru Kiran
Class Number(s) : VL2025260501203
Date of Examination : 23-03-2026
Exam Duration : 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- If you feel that data is missing, assume relevant data and continue the calculations

Q. No	Question	Marks																									
1.	Two different types of activated carbon filters, Filter C and Filter D, are being tested for their ability to remove toxins from water. The effectiveness is measured at different flow rates $X = \{10, 20, 30, 40\}$ (in litres per hour). The fuzzy sets representing the efficiency (membership value) are: $\bar{C} = \left\{ \frac{0.8}{10} + \frac{0.6}{20} + \frac{0.4}{30} + \frac{0.2}{40} \right\}$ $\bar{D} = \left\{ \frac{0.7}{10} + \frac{0.7}{20} + \frac{0.5}{30} + \frac{0.3}{40} \right\}$ Calculate the - union - Intersection - difference - Complement of $\bar{C}$	10																									
2.	A survey was conducted to determine people's preference for their favourite colour. The following pairwise comparison data (number of people who preferred the row colour over the column colour) was obtained: <table border="1"><thead><tr><th></th><th>Red</th><th>Blue</th><th>Black</th><th>White</th></tr></thead><tbody><tr><th>Red</th><td>—</td><td>37</td><td>49</td><td>33</td></tr><tr><th>Blue</th><td>63</td><td>—</td><td>90</td><td>81</td></tr><tr><th>Black</th><td>51</td><td>10</td><td>—</td><td>40</td></tr><tr><th>White</th><td>67</td><td>19</td><td>60</td><td>—</td></tr></tbody></table> Rank the colour from most preferred to least preferred using fuzzy rank of ordering.		Red	Blue	Black	White	Red	—	37	49	33	Blue	63	—	90	81	Black	51	10	—	40	White	67	19	60	—	10
	Red	Blue	Black	White																							
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Blue	63	—	90	81																							
Black	51	10	—	40																							
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3.	a) Compare Black box modelling, white box modelling & Grey box modelling (5 M)	10																									



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	b) Analyse how the hybrid modelling best choice over traditional modelling for heat transfer in packed bed system (5M)																										
4.	Develop the neural network model with a appropriate arch structure of the model for the following problem statement: A steady-state non-isothermal CSTR carries out: $A \rightarrow B$ First-order kinetics: $r_A = kC_A$ Given process data: <table><tr><th>Case</th><th>Feed Conc. (mol/L)</th><th>(CA0)</th><th>Residence Time (min)</th><th>Conversion (X)</th></tr><tr><td>1</td><td>3.0</td><td></td><td>1.0</td><td>0.52</td></tr><tr><td>2</td><td>3.0</td><td></td><td>2.0</td><td>0.68</td></tr><tr><td>3</td><td>2.5</td><td></td><td>1.5</td><td>0.58</td></tr><tr><td>4</td><td>2.0</td><td></td><td>3.0</td><td>0.78</td></tr></table> Note: Hidden layer: 2 neurons (ReLU activation) Output layer: 1 neuron (Linear activation)	Case	Feed Conc. (mol/L)	(CA0)	Residence Time (min)	Conversion (X)	1	3.0		1.0	0.52	2	3.0		2.0	0.68	3	2.5		1.5	0.58	4	2.0		3.0	0.78	10
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5.	A particle in a 1-dimensional search space is currently at position $x_k = 10$ with a velocity, $V_k = 2$. The following parameters are given: Inertia weight (w) = 0.8, Acceleration constants (c_1, c_2) = 2.0, Random values (r_1, r_2) = 0.5 and 0.2 respectively, Particle's best position ($P(\text{best})$) = 12, Swarm's global best position ($G(\text{best})$) = 15. Calculate the new velocity and the new position for the next iteration.	10																									
