Name: **Enrolment No:**	

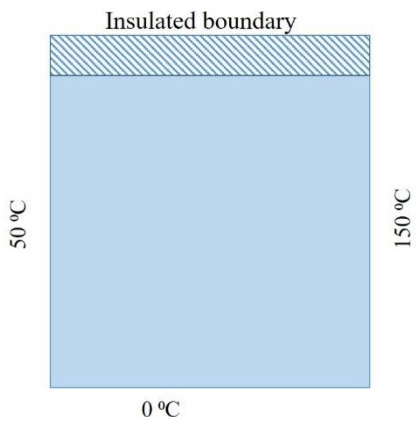
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2023

Programme Name: B.Tech (CERP) **Semester : IV**
Course Name : Numerical Methods in Chemical Engineering **Duration : 3 h**
Course Code : CHCE2019 **Max. Marks: 100**
Nos. of page(s) : 02

Instructions: In case of data missing make necessary assumptions

S.No.	**Section A** (Attempt all questions)	Marks	CO
Q 1	Given the equations $0.5x_1 - x_2 = -9.5$ and $1.02x_1 - 2x_2 = -18.8$ (a) Solve graphically (b) Compute the determinant (c) Solve by the elimination of unknowns.	12 M	CO1
Q 2	Employ (a) Fixed-point iteration and (b) the Newton-Raphson method to determine a root of $f(x) = -0.9x^2 + 1.7x + 2.5$ using x_o=5. Perform the computation until ε_a is less than ε_s =0.01%. Also perform an error check of your final answer.	12 M	CO2
Q 3	Evaluate $\int_0^2 e^{-x^2} dx$ by trapezoidal rule with n =8.	12 M	CO3
Q 4	Use Lagrange's interpolation formula to find the value of y when x = 12, if the values of x and y are given below: <table><tr><td>x</td><td>11</td><td>13</td><td>14</td><td>18</td><td>20</td><td>23</td></tr><tr><td>y</td><td>25</td><td>47</td><td>68</td><td>82</td><td>102</td><td>124</td></tr></table>	12 M	CO3
Q 5	Use Liebmann's method to obtain the temperature distribution of the square heated plate (Fig. 1). Use a relaxation factor of **1.2**. The dimensions of the plate is 6 cm × 6 cm. Use at-least two interior nodes in both horizontal and vertical directions. Note that the material is aluminum with specific heat, C = 0.2174 cal/(g · ºC) and density, ρ = 2.7 g/cm^3. The thermal conductivity, k' = 0.49 cal/(s · cm · ºC), $$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$	12 M	CO4

	 **Fig 1:** Schematics of the flat plate with boundary conditions.		
	Section B (Attempt all questions)		
Q 6	Solve the following set of differential equations using Euler's method, assuming that at x=0, y_1=4, and y_2=6. Integrate to x=1 with a step size of 0.25. $\frac{dy_1}{dx} = -0.5y_1$ and $\frac{dy_2}{dx} = 4 - 0.3\, y_2 - 0.1\, y_1$	20 M	CO4
Q 7	Using LU decomposition method Find A^{-1} if A=$\begin{bmatrix} 2 & 6 & 6 \\ 2 & 7 & 6 \\ 2 & 7 & 7 \end{bmatrix}$	20 M	CO2