Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

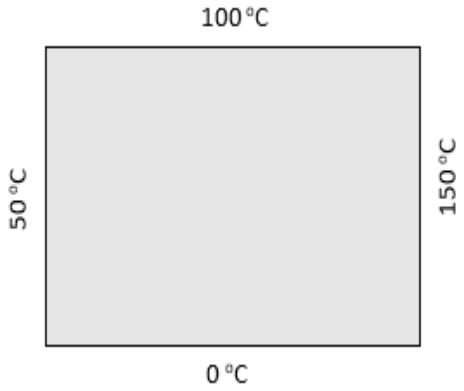
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2023

Programme Name: B.Tech (APE Gas) **Semester :** VI
Course Name : Numerical Methods in Chemical Engineering **Duration :** 3 h
Course Code : CHCE 3042 **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	What is the determinant for the given system of equations $-3x_2 + 7x_3 = 2$, $x_1 + 2x_2 - x_3 = 3$, $5x_1 - 2x_2 = 2$, and use Cramer's rule to find values of x's	12 M	CO1
Q 2	Infer the roots of the function, $f(x) = 4x^3 - 6x^2 + 7x - 2.3$ using Newton-Raphson method to locate the roots. Employ an initial guess of $x_o = 0$, and make 3 iterations and calculate the approximate error, ε_a for each iteration.	12 M	CO2
Q 3	Apply Simpson's 3/8 rule to solve the value of $\int_{0.2}^{1.4}(sinx - logx + e^x)dx$	12 M	CO3
Q 4	Given that $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$. Taking $h = 1.0$. infer $y(1.0)$ using Taylor series method by considering upto third degree term.	12 M	CO2
Q 5	Apply Liebmann's method to determine 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	CO5

	 **Fig 1:** Schematics of the flat plate with boundary conditions.		
	Section B (Attempt all questions)		
Q 6	Using Euler's, Midpoint, Heun's, and analytical method solve $\frac{dy}{dt} = (1 + 4t)\sqrt{y}$ over the interval from t=0 to 1 using a step size of 0.5. Where y(0)=1. Illustrate the results on the same graph.	20 M	CO4
Q 7	Find values of x_1, x_2, and x_3 using LU decomposition method for the following simultaneous linear equations: $3x_1 + 4x_2 + x_3 = 26$ $x_1 + 2x_2 + 6x_3 = 22$ $6x_1 - x_2 - x_3 = 19$ Detailed steps should be provided. Check your answers by substituting them into the original equations.	20 M	CO1