Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

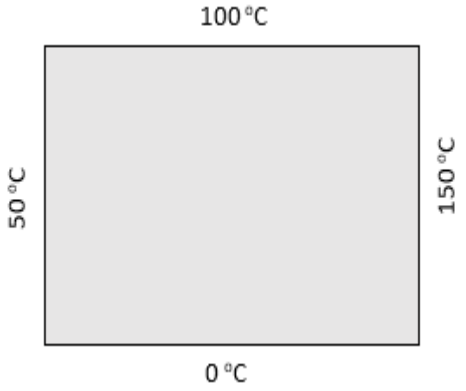
End Semester Examination, May 2024

Programme Name: B.Tech (Chemical Engineering) **Semester : IV**
Course Name : Numerical Methods in Chemical Engineering **Duration : 3 h**
Course Code : CHCE 2019 **Max. Marks: 100**
Nos. of page(s) : 02

Instructions: In case of data missing make necessary assumptions

S.No.	Section A (5X4=20M) (Attempt all questions)	Marks	CO
Q 1	Define absolute error and truncation error.	4 M	CO1
Q 2	Differentiate between bracketing and open methods to solve non-linear algebraic equations.	4 M	CO2
Q 3	Use the Taylor series method to find $y(0.25)$ considering upto third degree term, if y(x) satisfies $\frac{dy}{dx} = x^2 - y^2$, $y(0)$ =1.	4 M	CO4
Q 4	Establish an expression for Newton's 1st order interpolating polynomial.	4 M	CO3
Q 5	What are the differences between Dirichlet and Neumann boundary condition?	4 M	CO4
	Section B (4X10=40M) (Attempt all questions)		
Q 6	Find the square root of 10 and correct to three decimal places, by using Newton-Raphson iteration formula. OR Solve $x_1 + x_2 - x_3 = -3$, $6x_1 + 2x_2 + 2x_3 = 2$, and $-3x_1 + 4x_2 + x_3 = 1$ using Gauss Jordon without partial pivoting.	10 M	CO2
Q 7	Apply Trapezoidal rule to evaluate the value of $\int_{0.2}^{1.4}(sinx - logx + e^x)dx$ with n=10.	10 M	CO3
Q 8	Use Lagrange's interpolation formula to find the value of y when x = 12, if the values of x and y are given below:	10 M	CO3

x	11	13	14	18	20	23
y	25	47	68	82	102	124

Q 9	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), $$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$  **Fig 1:** Schematics of the flat plate with boundary conditions.	10 M	CO4
	Section C (2X20=40M) (Attempt all questions)		
Q 10	Using LU decomposition method Find A^{-1} if $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 4 & -6 \\ 1 & 5 & 3 \end{bmatrix}$	20 M	CO2
Q 11	Using Euler's, Midpoint, Heun's and analytical method solve $\frac{dy}{dt} = yt^2 - 1.1y$ over the interval from t=0 to 2 with a step size of 1. The initial condition is y(0)=1. Display all your results on the same graph.	20 M	CO3