Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech Mid Semester Exam

Semester: 4th **Date: (31/01/2024)**

Subject Code: 303103255 **Time: (1hr: 30min)**

Subject Name: Numerical Methods in Chemical Engineering **Total Marks: 40**

Sr. No.		Marks
Q.1	(A) Five One line Questions	05
	1. Write the formula of Simpson's 3/8 rule.	
	2. Name the Interpolation Methods used to solve equally spaced data.	
	3.Write the One-point Gaussian Quadrature formula.	
	4. Write the Three-point Gaussian Quadrature formula	
	5. Name the Interpolation Methods used to solve unequally spaced data.	
	(B) Five Fill in the blanks	05
	1. To apply simpson's 1/3 rule, the number of subintervals should be a multiple of _____	
	2. Second order Runga kutta method is also known as_____	
	3. For the value of $n = 3$,Newton-Cotes Quadrature formula gives _____rule.	
	4. $(1+\Delta)(1-\nabla)$= _____	
	5. To apply Trapezoidal rule, the number of subintervals should be a multiple of_____	
Q.2	Attempt any four(Short Questions)	12
	(1) Evaluate $\int_0^3 \frac{1}{1+x} dx$,with n=6 using Simpson's 3/8 rule.	
	(2) Given the data below, find the isothermal work done on the gas if it is compressed from $v_1 = 22L$ to $v_2 = 2L$ using Trapezoidal rule. Use W= $-\int_{v_1}^{v_2} p\, dv$.	

v_1, L	2	7	12	17	22
P, atm	12.20	3.49	2.049	1.44	1.11

(3) Use the second order R-K method to find an approximate value of y given that $\frac{dy}{dx} = 3x + y$ *and* $y(1) = 1.3$ at $x = 1.1$ with step size of 0.1.

(4) Evaluate $\int_{-1}^{1} \frac{1}{1+x^2} dx$ by One-point, Two-point and Three-point formulae.

(5) Evaluate $\int_{0}^{6} \frac{1}{1+x^2} dx$,with n=6 using Simpson's 1/3 rule

Q.3 Attempt any two questions 08

(1) Prove the following

(i)$\Delta\nabla = \Delta - \nabla$. (ii)$\nabla = 1 - E^{-1}$

(2) Find the approximate value of $y(5)$,by Lagrange's interpolation formula using the data $(-1,-2), (1,0), (4,63)$ *and* $(7,342)$.

(3) Determine the value of y *at* $x = 0.1$ correct up to four decimal places by taking $h =$ 0.1. Given that $y(0) = 1$ and $\frac{dy}{dx} = x^2 + y$ using Modified Euler's Rule.

Q.4 (A) Using Newton's Backward interpolation formula, find the value of $f(175)$. 05

x	140	150	160	170	180
$f(x)$	3685	4845	6302	8076	10225

(B) Using Newton's forward interpolation formula, find the value of $f(1.6)$. 05

x	1	1.4	1.8	2.2
$f(x)$	3.49	4.82	5.96	6.5

OR

(B) Using 4th order Runge-Kutta method, solve the equation Using R-K method of fourth order, solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ at $x = 0.2$ and step size of 0.1. 05