

2103000204023002
EXAMINATION FEBRUARY-MARCH 2024
BACHELOR OF SCIENCE (FOURTH SEMESTER)
MATHEMATICS PAPER-IX
(MTH-402 MATHEMATICS-IX)

[Time: As Per Schedule]

[Max. Marks: 50]

Instructions:

1. Fill up strictly the following details on your answer book
 - a. Name of the Examination : **BACHELOR OF SCIENCE (FOURTH SEMESTER)**
 - b. Name of the Subject : **MATHEMATICS PAPER-IX (MTH-402 MATHEMATICS-IX)**
 - c. Subject Code No : **2103000204023002**
2. Sketch neat and labelled diagram wherever necessary.
3. Figures to the right indicate full marks of the question.
4. All questions are compulsory.
5. Follow usual notations.
6. Use of scientific non-programmable calculator is allowed.

Seat No:

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Student's Signature

Q.1 Answer Any Five as directed:

10

- 1) Write the Lagrange's Interpolation Formula for unequally spaced values of arguments.
- 2) Construct the divided difference table for the following data :

X:	2	4	9	10
Y:	4	56	711	980

- 3) Divide the interval $[0, 1]$ into eight subintervals for applying Simpson's $\frac{1}{3}$ Rule.
- 4) Give the General Formula for Numerical Integration.
- 5) Write the formula for finding first and second derivatives at $x = x_n$
- 6) To use Simpson's 3/8 Rule, n must be _____ and the number of pairs (x, y) in the given data must be _____ ($k \in N$).

7) Find the divided differences [a, b, c] for $f(x) = \frac{1}{x^2}$.

8) If $y(1) = 4$, $y(3) = 12$, $y(x) = 19$, find the value of x .

Q.2 Attempt Any Two:

10

1) Using Lagrange's interpolation formula express the function

$\frac{x^2+x-3}{(x-1)(x+1)(x-2)}$ as the sum of partial fractions.

2) Given that $f(0) = 1$, $f(1) = 3$, $f(3) = 55$, find the unique polynomial through these points. Also find $f(2)$ and $f(2.5)$.

3) Given the tabulated points (1, -3), (3, 9), (4, 30), and (6, 132) find $y(2)$ and $y(5)$ using Newton's divided difference formula.

Q.3 Attempt Any Two:

10

1) From the following data, obtain second derivative at $x = 1.8$

X:	1.0	1.2	1.4	1.6	1.8
F(X)	2.7183	3.3201	4.0552	4.9530	6.0496

2) From the following data, obtain first and second derivatives at $x = 0.1$

X:	0.0	0.1	0.2	0.3	0.4
F(X)	1.0000	0.9975	0.9900	0.9776	0.9604

3) Derive the formula to find $\frac{d^2y}{dx^2}$ at $X=X_0$.

Q.4 Attempt Any Two:

10

1) Derive Simpson's $\frac{3}{8}$ rule for Numerical Integration.

2) Evaluate $\int_0^1 \frac{dx}{1+x+x^2}$ using Simpson's $\frac{1}{3}$ rule taking $h=0.125$.

3) Find the value of $\int_0^2 \left(\frac{x}{5+2x}\right) dx$ using Trapezoidal Rule With $n=10$.

- 1) Use Euler's Method to solve the problem $\frac{dy}{dx} = xy$; $y(0) = 1$ and find $y(0.1)$, $y(0.2)$, $y(0.3)$.
- 2) Explain Taylor's Series Method to solve initial value problem $\frac{dy}{dx} = f(x,y)$; $y(x_0) = y_0$.
- 3) Find $y(0.1)$ from $\frac{dy}{dx} = x + y^2$ up to the second approximation using Picard's method given that $y(0) = 1$.
