ST. JOSEPH'S UNIVERSITY, BENGALURU -27
BCA (DATA ANALYTICS) - III SEMESTER
SEMESTER EXAMINATION: OCTOBER 2023
(Examination conducted in November/ December 2023)
BCADA 3322: Mathematics III
(For current batch students only)

Time: 2 Hours   Max Marks: 60

This paper contains **TWO** printed pages and **THREE** parts.

PART A

Answer all the FIVE questions.   **[5X 2=10]**

1. Show that $lim_{(x,y)\to(0,0)} \dfrac{2xy^2}{x^2 + y^4}$ does not exist.

2. Define polynomial interpolation and write the derivative formula using Newton's backward difference.

3. Evaluate $f(1)$ and $f(3)$ for the function $f(x) = 5x^5 + 7x^2 + 3$.

4. Write the formula for Cubic Spline Interpolation.

5. Solve $\dfrac{dy}{dx} = \dfrac{y}{x}$

PART B

Answer any Five of the following.   **[5X 4=20]**

6. Show that at the origin $f_{xy} \neq f_{yx}$, where $f(x, y) = \dfrac{xy(x^2 - y^2)}{x^2 + y^2}, (x, y) \neq (0, 0), f(0, 0) = 0$.

7. Find the maxima and minima of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.

8. From the following values of x and y, obtain $\dfrac{dy}{dx}$ for x = 2.0, using Newton's difference method.

   (x,y) = (1.0, 2.7183), (1.2, 3.3201), (1.4, 4.0552), (1.6, 4.9530), (1.8, 6.0496), (2.0, 7.3891), (2.2, 9.0250)

9. Use Newton-Raphson's method to obtain the root of the polynomial $f(x) = x^3 - 3x + 1$ by taking $x_0 = 0$ up to three decimals.

10. Using Newton's Divided Difference method find the value of $f(x)$ at $x = 10$ for the following data.

x	5	6	9	11
$f(x)$	12	13	14	16

11. Solve $x\dfrac{dy}{dx} - 2y = 2x$.

12. Solve $(D^2 + 16)y = 14\,cos(3x)$

PART C

Answer any THREE of the following. [3X 10=30]

13. Find the maximum and minimum values of $x^2 + y^2 + z^2$ subject to the condition $\dfrac{x^2}{4} + \dfrac{y^2}{5} + \dfrac{z^2}{25} = 1$, and $z = x + y$.

14. (a) Let $f(x, y) = (x^2 + y^2 + z^2)^{\frac{1}{2}}$, then show that $\dfrac{\partial^2 f}{\partial x^2} + \dfrac{\partial^2 f}{\partial y^2} + \dfrac{\partial^2 f}{\partial z^2} = 0$. [5]

   (b) Evaluate $I = \int_0^1 \dfrac{1}{1 + x}\,dx$ correct to three decimal places using the trapezoidal and Simpson's rule with h = 0.125. [5]

15. Solve $(D^2 - 10D + 16)y = e^{4x}sin2x + e^{3x}$.

16. (a) Form a difference table and interpolate the value of $f(x)$ when $x = 4$, given

x	3	5	7	9
$f(x)$	180	150	120	90

[5]

   (b) Solve the given system of equation using Gauss-Seidel method:

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

[5]

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