D 110210 **(Pages : 3)** **Name.....**

Reg. No.....

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2024

Mathematics

MTS 5B 07—NUMERICAL ANALYSIS

(2020 Admission onwards)

Time : Two Hours Maximum : 60 Marks

Section A

Answer any number of questions.
Each question carries 2 *marks.*
Ceiling is 20.

1. Find the polynomial of degree one passing through the points $(1, 2)$ and $(2, -1)$.
2. What you mean by Interpolation.
3. Write The Newton's Forward difference formula.
4. State Fixed Point Theorem.
5. Show that the equation $f(x) = x^5 - x - 5$ has a root between 1 and 2.
6. State Weierstrass approximation theorem.
7. Find the zeroth divided difference of the function $f(x) = x^2 - 1$ at $x_1 = 2$.
8. Write Three Point Mid Point Formula
9. Write the Trapezoidal rule for $\int_0^2 \left(x^2 + 1\right) dx$.
10. Write Newton's iteration formula for computing $\sqrt[3]{7}$
11. Does the set $\{(t, y), -1 < t < 1, -1 < y < 1\}$ is a convex set ? Justify your answer.
12. State Lipschitz condition.

Turn over

Section B

Answer any number of questions.
Each question carries 5 *marks.*
Ceiling is 30.

13. Use Lagrange interpolating polynomial of degree three to approximate $f(10)$ if $f(5)=12, f(6)=13, f(9)=14, f(11)=16$.

14. The following table lists the values of f at various points.

x	$f(x)$
20	0.3420
23	0.3907
26	0.4384
29	0.4848

Use the Newton forward difference formula to construct interpolating polynomial for this data. Also find $f(21)$.

15. Find the real positive root of $f(x)=x-\cos x-1=0$ by Newton's method.

16. Consider the following table of data :

x	$f(x)$
50	3.6840
51	3.7084
52	3.7325
53	3.7563
54	3.7798
55	3.8030
56	3.8259

Use forward difference formula to approximate the value of $f'(50)$.

17. Evaluate $\int_{-3}^{3} x^4\,dx$ by using (i) Trapezoidal rule ; and (ii) Simpson's rule.

18. Apply Taylor's method of order two to approximate the solution for the initial value problem $y' = e^{t-y}, 0 \le t \le 1, y(0) = 1, h = 0.5$.

19. Use Euler's method to approximate the solution for $y' = y + e^t, y(0) = 0, h = 0.2$.

Section C

Answer any **one** *question.*
The question carries 10 *marks.*

20. Find the positive root of $x^4 - x^3 - 2x^2 - 6x - 4 = 0$ by Bisection method within 10^{-4} accuracy.

21. Use the Runge - Kutta method of order four with $h = 0.2, N = 10, t_i = 0.2i$ to obtain approximations to the solutions of the initial value problem $y' = y - t^2 + 1, 0 \le t \le 2, y(0) = 0.5$.

(1 × 10 = 10 marks)