D 30561 **(Pages : 2)** **Name.....**

Reg. No.....

FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION, NOVEMBER 2022

Mathematics

MTS 5B 07—NUMERICAL ANALYSIS

(2019 Admissions only)

Time : Two Hours Maximum : 60 Marks

Section A

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

1. State Intermediate value Theorem.
2. Determine the fixed points of the function $f(x) = x^2 - 2$.
3. Set up Newton's iteration formula for computing $\sqrt[3]{24}$.
4. State the formula for method of false Position.
5. Write the Lagrange Interpolating polynomial through (2, 4) and (5, 1).
6. Write Newton's Forward difference formula.
7. Write second derivative Mid Point formula.
8. Write Simpson's Three- Eighths Rule formula.
9. Define Numerical quadrature.
10. Show that $f(t,y) = t|y|$ satisfies a Lipschitz condition on the interval

    D = $\{(t,y) : 1 \le t \le 2, \text{ and } -3 \le y \le 4\}$.
11. What does local truncation error at a specified step of an approximation method measure ?
12. What is the local truncation error, if Taylor's method of order n is used to approximate the solution to $y'(t) = f(t, y(t)), a \le t \le b, y(a) = \alpha$ and with step size h and if $y \in C^{n+1}[a,b]$?

Turn over

Section B

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

13. Approximate the root of the function $f(x) = \cos x - x = 0$ using Newton's method with $p_0 = \pi/4$.

14. Given $f(2) = 5$, $f(2.5) = 6$. Evaluate $f(2.2)$ using Lagrange's Method.

15. Using Newton's divided difference interpolation formula evaluate $f(3)$ from the following table :

x	:	1	2	4	5	6
y	:	14	15	5	6	19

16. Use Newton's forward-difference formula to approximate the derivative of $f(x) = In\ x$ at $x_0 = 1.8$ using $h = 0.01$, $h = 0.05$ and $h = 0.01$ and determine bounds for the approximation errors.

17. The values for $f(x) = xe^x$ are given. Use Three-point end point formula to approximate $f'(2.0)$ with $h = 0.1, -0.1$:

x	:	1.8	1.9	2	2.1	2.2
xe^x	:	10.889365	12.703199	14.778112	17.148957	19.855030

18. Approximate the integral $\int_{0.5}^{1} x^4 dx$ using Trapezoidal Rule.

19. Use Euler Method to approximate the solution of the initial value problem

$y' = 1 + (t - y)^2, 2 \le t \le 3, y(2) = 1$ with $h = 0.5$.

Section C

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

20. Find a positive root of the equation $f(x) = xe^x - 1$ correct to 3 decimal places using Bisection Method.

21. Use the Midpoint method with N = 10, $h = 0.2$, $t_i = 0.2i$, and $w_0 = 0.5$ to approximate the solution to $y' = y - t^2 + 1,\ 0 \le t \le 2,\ y(0) = 0.5$.