Name: ....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2026

(Regular/Improvement/Supplementary)

ECONOMICS & MATHEMATICS (DOUBLE MAIN)

GDMT6B09T: NUMERICAL ANALYSIS

Time: 2 ½ Hours **Maximum Marks: 80**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 25 marks)

1. Use the Bisection method to find p_3 for the function $\sqrt{x} - cosx = 0\ on\ [0,1]$.
2. Explain Trapezoidal rule.
3. Define fixed point of a function. Give an example
4. Find a fixed point of the function $f(x) = x^2 - 2$.
5. Define Lipschitz condition. Give an example.
6. Determine the linear Lagrange interpolating polynomial that passes through the points (2,4) and (5, 1).
7. For the given function $f(x) = \sqrt{1+x}$, let $x_0 = 0$, $x_1 = 0.5$, and $x_2 = 1$, construct interpolation polynomials of degree at most 2 to approximate $f(0.6)$.
8. Write Newton's forward difference formula.
9. Describe Simpson's Rule.
10. Compare the Trapezoidal rule and Simpson's rule approximations to $\int_0^3 f(x)\,dx$ when $f(x) = x^4$.
11. Let $f(x) = 3(x+1)(x-\frac{1}{2})(x-1) = 0$. Find the third approximation of the root by using Bisection method on the interval [0,1].
12. Discuss various closed Newton Cotes formulas.
13. Show that $f(t,y) = t|y|$ satisfies a Lipschitz condition on the interval $D = \{(t,y)|1 \le t \le 2$ and $-3 \le y \le 4\}$.
14. Use Euler's method to approximate the solution of the initial-value problem
 $y' = 1 + (t-y)^2,\ 2 \le t \le 3,\ y(2) = 1\ with\ h = 0.5$.
15. Define an initial value problem. When do we say that an initial value problem is well-posed?

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 35 marks)

16. Find a root of $x^3 - 7x^2 + 14x - 6 = 0$ on [0,1] by Bisection method.
17. Approximate $\int_{0.5}^{1} x^4 dx$ using trapezoidal rule and find a bound for the error using the error formula and compare this to the actual error.
18. Show that $g(x) = \frac{x^2-1}{3}$ has a unique fixed point on the interval $[-1, 1]$.
19. Show that the initial-value problem $y' = \frac{2}{t}y + t^2e^t,\quad 1 \le t \le 2,\ y(1) = 0$ has a unique solution and find the solution.

(PTO)

20. Let $x_0 = 1$, $x_1 = 1.5$, and $x_2 = 2.9$. Construct interpolation polynomial of maximum degree for $f(x) = \ln(x+1)$ and hence find absolute error for $f(2)$.
21. Use the Newton forward-difference formula to construct interpolating polynomials for $f(x)$, if $f(0.1) = -0.62049958, f(0.2) = -0.28398668, f(0.3) = 0.00660095, f(0.4) = 0.24842440$. Also find $f(0.25)$.
22. Use the forward-difference formulas and backward-difference formulas to determine each missing entry in the following tables,

x	$f(x)$	$f'(x)$
0.5	0.4794	
0.6	0.5646	
0.7	0.6442	

23. Use Euler's method to approximate the solution of

$$y' = te^{3t} - 2y, \quad 0 \le t \le 1, \quad y(0) = \quad 0, \quad with\, h = 0.5.$$

SECTION C: Answer any *two* questions. Each carries *ten* marks.

24. Find an approximation to $\sqrt[3]{25}$ correct to within 10^{-4} using Bisection method
25. a) Approximate $f(0.05)$ using the following data and the Newton forward-difference formula

x	0.0	0.2	0.4	0.6	0.8
$f(x)$	1.00000	1.22140	1.49182	1.82212	2.22554

b) Use the Newton backward-difference formula to approximate f (0.65).

c) Use Stirling's formula to approximate$f$0.43).

26. Given the function f at the following values,

x	1.8	2.0	2.2	2.4	2.6
$f(x)$	3.12014	4.42569	6.04241	8.03014	10.46675

approximate $\int_{1.8}^{2.6} f(x)dx$ using any four suitable quadrature formulas.

27. Find $y(2)$ using Euler's method, given $y' = \frac{1+t}{1+y}, 1 \le t \le 2, y(1) = 2$. Actual solution is $y(t) = t + \frac{1}{1-t}$. Find the actual error also.

(2 x 10 = 20 Marks)