D6BMC2203 (PAGES 2) **Reg. No.....**

Name: .....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2025

COMPUTER SCIENCE AND MATHEMATICS (DOUBLE MAIN)

GDMA6B10T: NUMERICAL ANALYSIS

Time: 2 Hours **Maximum: 60 Marks**

SECTION A: Answer the following questions. Each carries *two* marks.

(Ceiling 20 marks)

1. What is the remainder term or bound for the error involved in approximating a function $f(x)$ by an interpolating polynomial $P(x)$.
2. What is the difference equation associated with Euler's method?
3. Define forward difference and backward difference.
4. Express $\nabla^2 f_3$ in terms of the values of the function.
5. Write the conditions for applying Bisection algorithm to find a root for f(x) = 0 on the interval [a,b].
6. Determine the linear Lagrange interpolating polynomial that passes through the points (2, 4) and (5, 1).
7. Write Second derivative midpoint Formula to approximate $f''(x)$ at x_0.
8. Write Simpson's three-eighths rule for approximating $\int_a^b f(x)\,dx$.
9. Find h when approximating $\int_0^2 \frac{1}{1+x}\,dx$ using Trapezoidal rule.
10. Give an example of a Lipschitz function $f(t, y)$.
11. Define Numerical quadrature.
12. Write number of iteration necessary to approximate y(1.2) from the IVP.
    y' = y − t^2 + 1, 0 ≤ t ≤ 2, y(0) = 0.5 h = 0.2 using Runge Kutta method of order 4.

SECTION B: Answer the following questions. Each carries *five* marks.

(Ceiling 30 marks)

13. Use Stirling's formula to approximate f (0.43) for the following data:

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

14. Compare the Trapezoidal rule when approximating $\int_0^2 x^2\,dx$.

(PTO)

15. Using Runge-Kutta method of order four to find w_1 for the following initial-value problem: $y' = cos\,2t + sin\,3t,\ 0 \leq t \leq 1,\ y(0) = 1, with\ h = 0.5.$
16. Use a fixed-point iteration method to determine a solution accurate to within 10^{-4} for x = tan x, for x in [4, 5].
17. Show that there is a unique solution to the initial-value problem y' = 1 + t sin(ty), $0 \leq t \leq 2$, y(0) = 0.
18. For the given function f (x) = tan x, let $x_0 = 0$, $x_1 = 0.6$. Construct interpolation polynomial of degree one to approximate f (0.45), and find the absolute error.
19. Use Euler's method to approximate the solution for the following initial-value problem:
$y' = 1 + (t - y)^2,\ 2 \leq t \leq 3,\ y(2) = 1, with\ h = 0.5$

SECTION C: Answer any *one* question. The question carries *ten* marks.

20. The equation $x^2 - 10 \cos x = 0$ has two solutions, ±1.3793646. Use Newton's method to approximate the solution to within 10^{-5} with $p_0 = -100$.
21. Approximate $\int_0^2 \frac{1}{1+x}\,dx$ using:
    a. Trapezoidal rule and find absolute error.
    b. Simpson's rule and find absolute error.

(1 x 10 = 10 Marks)