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D5BMT2303 **Reg. No.....**

Name: .....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2025

(Regular/Improvement/Supplementary)

MATHEMATICS

GMAT5B07T: NUMERICAL ANALYSIS

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

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

(Ceiling 20 marks)

1. Define round-off error.
2. Determine the relative error when approximating p by $p^*$when p = 0.3 and p^*= 0.31.
3. Determine the number of iterations necessary to solve $f\ (x) = x^3 + 4x^2 - 10 = 0$ by Bisection method with an accuracy 10^{-3} using a_1 = 1 and b_1 = 2.
4. Define fixed point for a function. Give an example.
5. Let f (x) = e^x , for 0 ≤ x ≤ 2. Approximate f (0.25) using linear interpolation with x_0 = 0 and x_1= 0.5.
6. Find second divided differences involving $x_0 = 1, x_1 = 1.3, x_2 = 1.6$ when $f(x) = \frac{1}{x}$.
7. Use the Newton forward-difference formula approximate$f(0.25)$, when $f(0.2)$ = −0.28398668, $f(0.3)$ = 0.00660095.
8. Use the backward difference formula to approximate $f'(-0.1)$ when $f(x) = 2cos2x - x$ and h = -0.1.
9. Define the degree of precision of a quadrature formula and give an example.
10. Define a well-posed initial value problem.
11. Show that $f(t, y) = t^{-2}(sin2t - 2ty), 1 \le t \le 2, y(1) = 2$ has a unique solution.
12. Explain the Taylor method of order 2 for solving an initial value problem.

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

(Ceiling 30 marks)

13. Find a solution accurate with in $10^{-4}$for $e^x - x^2 + 3x - 2 = 0, 0 \le x \le 1$ using the Bisection method.

(PTO)

14. Using the method of false position find the real root of the equation:
    $2x + 3cosx - e^x = 0$ in [1, 2].
15. Construct a Lagrange interpolation polynomial of degree 3 to approximate $f(0.43)$ if $f\ (0) = 1, f\ (0.25) = 1.64872, f\ (0.5) = 2.71828, f\ (0.75) = 4.48169$.
16. Find $f(0.65)$ using Newton backward -difference formula if
    $f\ (0)\ 1,\ f\ (0.2) = 1.2214, f\ (0.4) = 1.49182, f\ (0.6) = 1.82212, f(0.8) = 2.22554$.
17. Approximate $f''(1.3)$ from the data $f(1.2) = 11.59006$, $f(1.29) = 13.78176$, $f(1.3) = 14.04276, f(1.31) = 14.30741, f(1.40) = 16.86187$ using all possible values of h.
18. Using the composite Trapezoidal rule approximate $\int_0^1 e^{-x^2} dx$ with n = 10.
19. Use the Eulers method with h = 0.1 to solve $y' = t^2 + y^2, 0 \leq t \leq 0.5, y(0) = 0$.

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

20. Determine the values of n and h required to approximate $\int_0^2 e^{2x} sin3x\ dx$ within 10^{-4} and compute the approximation. Use
    a) Composite Trapezoidal rule.
    b) Composite Simpson's rule.
21. Use the Runge -Kutta method of order four with $h = 0.5$ to obtain an approximation of the solution of $y' = te^{3t} - 2y, 0 \leq t \leq 1, y(0) = 0$.

(1 × 10 = 10 Marks)