(FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2024 ONLY)

24PMS209

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : MAY - 2025

M.Sc.-MATHEMATICS **MAXIMUM MARKS: 75**

SEMESTER: IV **TIME : 3 HOURS**

PART - III

NUMERICAL ANALYSIS

SECTION – A **(10 X 1 = 10 MARKS)**

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. **(K1)**

1. $x_{n+1} = x_n - f(x_n)\frac{x_n - x_{n-1}}{f(x_n) - f(x_{n-1})}$ represents ________.

   a) Secant method b) Bisection method c) Newton's Raphson method d) Muller method

2. If $A = \begin{bmatrix} -5 & 3 \\ 7 & 2 \end{bmatrix}$ then find det(A)?

   a) 21 b) -21 c) 31 d) -31

3. If $g(x)$ is a continuous function on some interval [a,b] and differentiable on (a,b) and if $g(a) = 0$, $g(b) = 0$, then there is _______c inside (a,b) for which $g'(c) = 0$.

   a) At least one point b) At least two point c) At most one point d) At most two point

4. The local error term for the fourth-order Runge-Kutta method is ______.

   a) $O(h^5)$ b) $O(h^2)$ c) $O(h^3)$ d) $O(h^4)$

5. A one root of the Characteristic equation $\lambda^3 - 8\lambda^2 + 14\lambda - 1 = 0$ is ______________.

   a) 7.4443 b) 5.4773 c) 3.2221 d) 0.7458

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES **(K2)**

6. If $f(x)$ is a continuous function on some interval [a,b] and $f(a)f(b) < 0$, then show that the equation $f(x) = 0$ has atleast one real root or an odd number of roots in the interval (a,b).
7. Find the solution of the system of equation 2x+3y=7;3x-y=5.
8. Find the error in the Simpson's rule is of the order.
9. Write the error of one step of the modified Euler's method.
10. What is meant by Characteristic-Value problems?

SECTION – B **(5 X 5 = 25 MARKS)**

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. **(K3)**

11. a) Show that the real root of $f(x) = 3x + \sin x - e^x$ by using Secant method is 0.3604217.

(OR)

b) Show that the negative root of $f(x) = x^3 + 2x^2 - x + 5$ by using Newton's method is –2.92585.

12. a) Find the inverse of $A = \begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & 1 \\ 1 & 0 & 2 \end{bmatrix}$

(OR)

b) Find the determinant of $\begin{vmatrix} 1 & 4 & -2 & 3 \\ 2 & 2 & 0 & 4 \\ 3 & 0 & -1 & 2 \\ 1 & 2 & 2 & -3 \end{vmatrix}$

13. a) Compute $f'(x)\ at\ x = 4.1$ for the following table

x	0	2	3	5	6
F(x)	1	3	7	21	31

(OR)

b) Apply Simpson's three-eight rule and Evaluate $I = \int_{0.2}^{1.5} e^{-x^2}\,dx$.

14. a) Calculate $y(0.6)$ for $\frac{dy}{dx} = -2x - y, y(0) = -1$using the Runge-kutta-Fehlberg method with h=0.2.also compute the error.

(OR)

b) Compute the predicted value for $y(x_0 + 0.1) for\ \frac{dy}{dx} = f(x,y) = -2x - y, y(0) = -1$.

15. a) Solve $\frac{d^2y}{dx^2} = y; \quad y(1) = 1.1752, \quad y(3) = 10.0179.$

(OR)

b) Solve the Successive approximations to finite-difference equations for

$$x'' = t\left(1 - \frac{t}{5}\right)x, \qquad x(1) = 2; \ \ x(3) = -1.$$

SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) Determine a root of $f(x) = x^3 + x^2 - 3x - 3$ starting with a=1,b=2 and tolerance of 1E-4 by interval halving.

(OR)

b) Determine a root of $f(x) = 3x + \sin x - e^x$ by using Muller's method.

17. a) Solve the system of equation using Gaussian elimination method
$4x - 3y = -7; 2x + 2y + 3z = -2; 6x + y - 6z = 6.$

(OR)

b) Solve the system of equation using Iterative method
$6x - 2y + z = 11; x + 2y - 5z = -1; -2x + 7y + 2z = 5.$

18. a) Estimate the second derivative at x=1.3 using one, two and three terms of derivative. Also estimate the errors of each for the following

X	1.10	1.30	1.50	1.70	1.90	2.10	2.30
f	3.24075	2.96479	2.65999	2.33333	1.99221	1.64421	1.29688

(OR)

b) Evaluate $I = \int_{0.2}^{1.5} e^{-x^2} dx$ using the Romberg integration formula.

19. a) Solve $\frac{dx}{dt} = f(t,x,y) = xy + t, x(0) = 1, \frac{dy}{dt} = g(t,x,y) = ty + x, y(0) = -1$ using Runge-kutta-Fehlberg.

(OR)

b) Solve $\frac{dx}{dt} = xy + t, x(0) = 1, \frac{dy}{dt} = ty + x, y(0) = -1$ using Taylor-series method.

20. a) Solve a second-order equation by the shooting method:

$$x'' = t\left(1 - \frac{t}{5}\right)x, \qquad x(1) = 2; \;\; x(3) = -1.$$

(OR)

b) Solve the equation $y'' + y = 3x^2$ with boundary points (0, 0) and (2, 3.5). Use polynomial trial functions up to degree 3.

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