

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted from the academic year 2015–16 % thereafter)

SUBJECT CODE: 15MT/ME/NM55

B. Sc. DEGREE EXAMINATION, APRIL 2019
BRANCH I – MATHEMATICS
SIXTH SEMESTER

COURSE : MAJOR ELECTIVE
PAPER : NUMERICAL METHODS WITH PROGRAMS IN C (THEORY)
TIME : 1½ HOURS **MAX. MARKS: 60**

SECTION-A

ANSWER ALL QUESTIONS:

10 × 2 = 20

1. What is the order of convergence of Newton Raphson Method?
2. Give the names of any 2 iteration methods for solving algebraic equations.
3. Find the divided difference table for the following data

x	0	2	3	4	7	8
y	4	26	58	112	466	668

4. When should we use Newton's backward interpolation formula.
5. Write the formula for computing $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$ based on Newton's backward interpolation formula.
6. Write the formula to compute $f''(x_k)$ by the method of undetermined coefficients.
7. Write the composite trapezoidal rule.
8. Write Simpson's $3/8^{\text{th}}$ rule.
9. Solve $y' + y = 0, y(0)$ for $x = 0.1$ by Euler's method.
10. Write k_2, k_4 values in Runge-kutta's formula of 4^{th} order.

SECTION-B

ANSWER ANY FIVE QUESTIONS:

5 × 8 = 40

11. Find a real root of the equation $X^3 - 3x + 1 = 0$ lying between 1 and 2 by using bisection method.
12. Solve the following equation using Jacobi's iteration method
 $3x + 4y + 15z = 54.8, \quad x + 12y + 3z = 39.66, \quad 10x + y - 2z = 7.74.$

13. The population of a town in the census is as given in the data. Estimate the population in the year 1996 using Newton's forward interpolation formula.

Year (x)	1961	1971	1981	1991	2001
Population (y)	46	66	81	93	101

14. Use Newton's divided difference formula to find $f(5)$ and $f(9)$ from the following data.

X	0	2	3	4	7	8
$f(x)$	4	26	58	112	466	668

15. Find the values of $f''(5)$ from the following table, using numerical differentiation based on Newton's backward interpolation formula.

x	0	1	2	3	4	5
$f(x)$	4930	5026	5122	5217	5312	5407

16. Evaluate $\int_0^{10} \frac{dx}{1+x^2}$ by using

i. Trapezoidal rule.

ii. Simpson 1/3rd rule.

17. Given $y' = x^2 - y$, $y(0) = 1$ find $y(0.1)$ using RungeKutta's 4th order.



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SECTION-C

ANSWER ANY TWO QUESTIONS:

2 X20 = 40

1. Write a C program to compute the smallest positive root of the equation $f(x) = x^3 + 3x - 1$ by Newton-Raphson method.
2. Write a C program to find y , where $x = 6$, using the given pairs of values of x and y by Lagrange's's interpolation formula.

x	4	5	7	10	11	13
y	48	100	294	900	1210	2028

3. Write a C program to find the derivative of the tabulated function at the final point by Newton's backward interpolation formula.

x	50	51	52	53	54	55	56
y	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

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SECTION-C

ANSWER ANY TWO QUESTIONS:

2 X20 = 40

1. Write a C program to find the smallest positive root / the largest negative root of the equation $f(x) = 0$, by using the bisection method.
2. Write a C program to find the derivative at the initial point of a tabulated function by Newton's forward interpolation formula.
3. Write a C program to solve simultaneous differential equations $\frac{dy}{dx} = f(x, y, z)$, $\frac{dz}{dx} = g(x, y, z)$, $y(X_0) = Y_0$, $z(X_0) = Z_0$ at the specified pivotal points, by using Runge – Kutta method of the fourth order.

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