



Register Number:

Date:

St. Joseph's College (Autonomous), Bangalore-27
M.Sc Mathematics - IV Semester
Semester Examination: April 2022
(Examination conducted in July 2022)
MTDE0818 - Numerical Analysis

Time: 2.5 Hours

Max. Marks: 70

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1. The paper contains only **TWO** pages.
 2. Attempt any **SEVEN FULL** questions.
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1. (a) Define absolute and relative error. [2m]
(b) Find absolute and percentage accuracy, given $X = 0.51$ is correct to 2 decimal places. [2m]
(c) Determine if the system is well conditioned or ill conditioned using the maximum absolute row sum norm.

$$A = \begin{bmatrix} 1 & 4 & 9 \\ 4 & 9 & 16 \\ 9 & 16 & 25 \end{bmatrix} \quad [6m]$$

2. Derive the operational count for Standard Gaussian Elimination. [10m]
3. Solve the system using Thomas algorithm.

$$2x_1 - x_2 = 1$$

$$-x_1 + 2x_2 - x_3 = 0$$

$$-x_2 + 2x_3 - x_4 = 0$$

$$-x_3 + 2x_4 = 1$$

[10m]

4. Solve using Cholesky decomposition

$$x_1 + 2x_2 + 3x_3 = 5$$

$$2x_1 + 8x_2 + 22x_3 = 6$$

$$3x_1 + 22x_2 + 82x_3 = -10$$

[10m]

5. Solve the given system using *SOR* method upto 4 iterations by taking the relaxation parameter as 1.25

$$27x + 6y - z = 85$$

$$6x + 15y - 2z = 72$$

$$x + y + 54z = 110$$

[10m]

6. (a) Determine the normal equations if the function $z = a_0 + a_1x + a_2y$ is fitted to the data (x_i, y_i, z_i) , where $i = 1, 2, 3, \dots, m$ [5m]

(b) Find the best values of a_0 and a_1 if the straight line $y = a_0 + a_1x$ fitted to the data

$(x_i, y_i) : (1, 0.6), (2, 2.4), (3, 3.5), (4, 4.8), (5, 5.7)$ [5m]

7. Determine the Hermite polynomial of degree 5, which fits the following data and hence find the approximate value of the Hermite polynomial at $x = 2.7$

x	y=ln x	y'=1/x
2.0	0.69315	0.5
2.5	0.91629	0.4
3.0	1.09861	0.333

[10m]

8. Obtain the cubic spline interpolation for the function $f(x) = x^4$ on $-1 \leq x \leq 1$, with clamped condition $h = 1, n = 2$.

x	-1	0	1
f(x)	1	0	1

[10m]

9. Deduce Simpson's $\frac{1}{3}$ rule using Newton's forward difference formula. And, hence estimate the error. [10m]

10. Solve the boundary value problem $y'' - 64y + 10 = 0, y(0) = y(1) = 0$ using shooting method with the initial guess $m_1 = 0.5$ and $m_2 = 0.6$. Use the Taylor series method with $h = 0.5$ to find the value of y at $x = 0.5$. [10m]