2026

MATHEMATICS

(Major)

Paper : MAT4200204MJ

(Numerical Analysis—I)

Full Marks : 45

Time : 2 hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : **1×5=5**

(a) Where is Euler's method used?

(b) Find $E\cos 2x$, where E is the shift operator.

(c) Find $\Delta^{n+1}x^n$.

(d) Define operator Δ and E.

(e) Write the formula for Simpson's $\frac{1}{3}$rd rule.

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2. Solve the following questions (*any five*) : **2×5=10**

(a) Write a short note on "Gauss Elimination Method".

(b) Prove that $\Delta = E - 1$. Where Δ is forward difference and E is shift operator.

(c) Construct the divide difference table for

x	4	5	7	9	11	13
y	48	100	294	900	1210	2028

(d) Show that the third divide difference of the function $f(x) = \frac{1}{x}$ with arguments a, b, c, d is $\frac{-1}{abcd}$.

(e) What are the advantages of Lagrange's interpolation formula?

(f) Write down two differences between Gauss-Seidel and Jacobi methods.

(g) Define partial pivoting and explain why it is used.

(h) State Simpson's $\frac{3}{8}$ th rule and its error term.

(i) Prove that $\Delta - \nabla = \Delta\nabla$. Where Δ denotes forward difference and ∇ denotes backward difference.

(j) Write one disadvantage of Euler's method.

3. **Solve the following questions (*any four*) :** **5×4=20**

(a) Solve the following linear equations by using Gauss Jordan method :

$$x + 3y + 5z = 14;\ 2x - y - 3z = 3;\ 4x + 5y - z = 7$$

(b) The following table gives the normal weight of a baby during the 6 months of life. Estimate the weight of the baby at 4th month.

Age (month)	0	2	3	5	6
Weight	5	7	8	10	12

(c) Find the missing term in the following table.

x	1	2	3	4	5
$y = f(x)$	2	5	7	—	32

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(d) Prove that : $\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$

(e) Use Trapezoidal Rule to find the value of $\int_0^6 \frac{dx}{1+x}$ by taking six ordinates.

(f) Write down the Lagrange's polynomial passing through the point (x_0, f_0), (x_1, f_1) and (x_2, f_2). Hence express $\frac{3x^2 + x + 1}{(x-1)(x-2)(x-3)}$ as a sum of partial function.

(g) Given that $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0{\cdot}8660$, Find the value of $\sin 52^\circ$.

(h) Write a brief note on modified Euler's method.

4. **Solve the following questions (*any one*) :** **10×1=10**

(a) Derive the general quadrature formula. Hence deduce Trapezoidal rule.

(b) Using the Euler's method, compute $y(0{\cdot}1)$ with step size $0{\cdot}025$ for the differential equation $\frac{dy}{dx} = \frac{y-x}{y+x'}$ with $y=1$ when $x=0$.

(c) Obtain piecewise quadratic interpolation polynomial for the following data. Hence find $f(-0{\cdot}5)$ and $f(2{\cdot}0)$

x	-2	0	1	3	4
$f(x)$	-23	1	4	82	193

(d) Solve the system of equation correct to three decimal places using Jacobi iteration method.

$$x+17y-2z=48$$
$$30x-2y+3z=75$$
$$2x+2y+18z=30$$

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