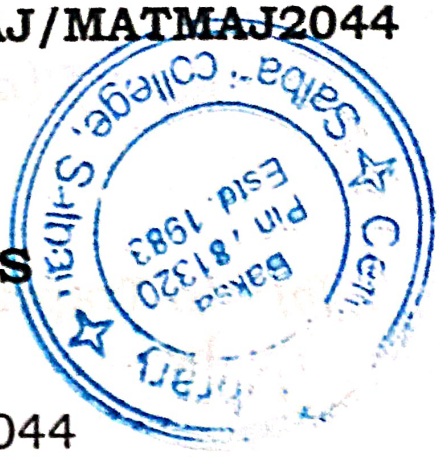
Total number of printed pages–7

63(FY)SEM–4/MAJ/MATMAJ2044

2025



MATHEMATICS

(Major)

Paper : MATMAJ2044

(Numerical Methods)

Full Marks : 50

Pass Marks : 20

Time : Two hours

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

1. Choose the correct answer from the following : 1×5=5

   (a) The condition for convergence of Newton-Raphson's method to a root α is

   (i) $f'(\alpha)/f''(\alpha)<1$

   (ii) $f'(\alpha)/f''(\alpha)>1$

(iii) $f'(\alpha)/2f''(\alpha) > 1$

(iv) $f'(\alpha)/2 > 1$

(b) In Trapezoidal rule, the function must be

(i) quadratic

(ii) cubic

(iii) biquadratic

(iv) linemar

(c) The value of n^{th} differences of a polynomial of degree n is

(i) zero

(ii) constant

(iii) variable

(iv) less than zero

(d) In LU-decomposition method, the diagonal element in L are all-

(i) 0

(ii) - 1

(iii) 1

(iv) 2

(e) In Simpson's $\frac{1}{3}^{rd}$ rule the function $y = f(x)$ is taken to be

(i) circle

(ii) ellipse

(iii) parabola

(iv) line

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

(i) Write *any two* limitations of Newton-Raphson's method for finding roots.

(ii) Define Lagrange's forward interpolation.

(iii) Write the formula of Runge-kutta method of order three and four.

(iv) If $f(x)=\frac{x}{x+1}$, then find $\Delta^3 f(x)$.

(v) If 1.414 is used as an approximation to $\sqrt{2}$ find the absolute and relative error.

(vi) Calculate the value of the integral

$$\int_4^{5\cdot2} \log x\,dx$$

by Trapezoidal rule.

(vii) Prove that $(1+\Delta)(1-\nabla)=1$.

3. Answer the following questions : ***(any five)*** 5×5=25

(a) Find the positive root of $\cos x - xe^x = 0$ in four steps, using Bisection method.

(b) Given

x	1	2	3	4	5	6	7	8
$f(x)$	1	8	27	64	125	216	343	512

find $f(7\cdot5)$.

(c) Solve :

$$2x+3y+z=9$$
$$x+2y+3z=6$$
$$3x+y+2z=8$$

by LU decomposition method.

(d) Let $dy/dx=\frac{y-x}{x+y}$, with boundary conditions $y=1$ when $x=0$, find approximately y for $x=0\cdot1$, by Euler's modified method in five steps.

(e) If $dy/dx = y - x$ with $y(0) = 2$, find $y(0{\cdot}1)$ and $y(0{\cdot}2)$ correct to four decimal places by Runge-kutta fourth order method.

(f) Estimate the error in Simpson's $\frac{3}{8}$th rule.

(g) Find a root of the equation $x - e^{-x} = 0$ correct to three decimal places by the secant method.

(h) Solve the following equations by Gauss-Seidal method.

$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$

4. Answer the following questions : ***(any one)*** $10 \times 1 = 10$

(a) Show that Bisection method is always convergent.

(b) Derive Newton-Gregory forward interpolation formula and remainder form.
