4 SEM TDC MTMH (CBCS) C 8

2025

(May/June)

MATHEMATICS

(Core)

Paper : C–8

(Numerical Methods)

Full Marks : 60

Pass Marks : 24

Time : 3 hours

The figures in the margin indicate full marks for the questions

Use of scientific calculator is allowed

1. (a) State true or false : 1

An exact number may be regarded as an approximate number with error zero.

(b) Write an algorithm to find the root of a linear equation. 2

(c) Define relative error and absolute error. 1+1=2

2. (a) State true or false : 1

Bisection method is always convergent.

(b) Describe secant method for solving an algebraic equation. 4

Or

Find a real root of the equation

$$x^3 - 2x - 5 = 0$$

by secant method correct up to three decimal places.

(c) Describe the geometrical interpretation of Newton-Raphson method. 5

Or

Determine the real root of

$$2x = \cos x + 3$$

by using iteration method correct up to three decimal places.

3. (a) Describe Gauss-Seidel method for the solution of system of linear equations. 5

Or

Solve by Gaussian elimination method

$$x + y - z = 2$$
$$2x + 3y + 5z = -3$$
$$3x + 2y - 3z = 6$$

(b) Solve by Gauss-Jordan method

$$5x - 2y + 3z = -1$$
$$-3x + 9y + z = 2$$
$$2x - y - 7z = 3$$

5

(Continued)

Or

Find the solution of the following system of equations by Gauss-Jacobi method :

$$5x + 2y + z = 12$$
$$x + 4y + 2z = 15$$
$$x + 2y + 5z = 20$$

4. (a) Define interpolation. 1

(b) Evaluate

$$\Delta^3(1-x)(1-2x)(1-3x)$$

if $h = 1$. 2

(c) Construct forward difference table for the following values : 2

x	0	5	10	15	20	25
y	5	9	12	16	22	30

(d) Deduce Lagrange's interpolation formula. 5

Or

The population of a town is as follows :

Year	x	1971	1981	1991	2001	2011	2021
Population in lakhs	y	30	35	41	48	58	70

Estimate the population for the year 1985.

(Turn Over)

5. (a) Deduce trapezoidal rule for numerical integration. 5

(b) Use the midpoint rule with $M = 5$ to approximate the integral

$$\int_{-1}^{1} \frac{dx}{1+x^2}$$ 5

(c) Evaluate $\int_0^{10} x^2 dx$ by Simpson's $\frac{1}{3}$rd rule. 5

Or

Evaluate $\int_{0\cdot 2}^{0\cdot 6} \frac{dx}{1+x}$ by Boole's rule correct to three decimal places, use $n = 4$.

6. (a) Find $y(0, 2)$, by Euler's method, from the equation $\frac{dy}{dx} = x^3 + y$, $y(0) = 1$, correct up to four decimal places, taking $h = 0\cdot 1$. 4

(b) Write the computational formulae for Runge-Kutta method of order two. 6

Or

Using Runge-Kutta method of fourth order, find the numerical solution at $x = 0\cdot 2$ for

$$\frac{dy}{dx} = 1 + y + x^2, \; y(0) = 0 \cdot 5$$

taking $h = 0\cdot 2$.

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