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4 SEM TDC MTMH (CBCS) C 8**2024**

(May/June)

MATHEMATICS

(Core)

Paper : C-8

(Numerical Methods)Full Marks : 60Pass Marks : 24

Time : 3 hours

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

- (a) Define a flowchart. 1
- (b) Write an algorithm to find the sum and product of two numbers. 2
- (c) The number $x = 49.67235$ is rounded off to four significant figures. Compute the absolute error and relative error. 1+1=2
4. (a) State true or false : 1
A transcendental equation may have infinite number of roots.
- (b) Find a real root of the equation $x^3 - 5x + 1 = 0$ by secant method, correct up to four decimal places. 4

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(Turn Over)

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MATHEMATICS

(2)

Or

Find a real root of the equation $x^3 - 2x^2 - 4 = 0$ by the method of bisection correct up to 3 decimal places.

- (c) Describe Newton-Raphson method for solving algebraic equation. 5

Or

Apply Newton-Raphson method to find $\sqrt{12}$.

3. (a) Solve

$$x + y - 3z = 3$$

$$2x - 3y + 4z = -4$$

$$x - y + z = -1$$

by Gaussian elimination method. 5

Or

Find the solution of the system

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

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

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

by Gauss-Jacobi method up to three iterations.

- (b) Find the solution of the system of equations

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

$$-3x + 9y + z = 2$$

$$2x - y - 7z = 3$$

by Gauss-Seidel method up to four iterations. 5

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(Continued)

(3)

Or

Describe Gauss-Jordan method.

4. (a) Show that $(1 + \Delta)(1 - \nabla) = 1$. 1

- (b) The following data represents the function $f(x) = \cos(x + 1)$:

x	0.0	0.2	0.4	0.6
$f(x)$	0.5403	0.3624	0.1700	-0.0292

Estimate $f(0.5)$ using the Newton's backward difference interpolation. 4

- (c) Deduce Lagrange's interpolation formula. 5

Or

Construct the divided difference table for the following data :

x	0.5	1.5	3.0	5.0	6.5	8.0
$f(x)$	1.625	5.875	31.0	131.0	282.125	521.0

Hence, find the interpolating polynomial.

5. (a) Evaluate $\int_0^1 \frac{dx}{1+x}$ using trapezoidal rule. 5

Or

Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $\frac{3}{8}$ th rule.

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(4)

- (b) Evaluate $\int_1^2 \frac{1}{x} dx$ using Simpson's $\frac{1}{3}$ rd rule. 5
- (c) Evaluate $\int_0^4 \frac{1}{1+x^2} dx$ using Boole's rule using $h = 0.5$. 5

Or

Use the midpoint rule to estimate

$$\int_{-0.5}^{3.5} \frac{x^3}{4} dx$$

using four subintervals.

6. (a) Deduce Euler's method for first-order and first-degree differential equation. 5
- (b) Using Runge-Kutta method of fourth-order, find the numerical solution at $x = 1.2$ for

$$\frac{dy}{dx} = xy, y(1) = 2$$

assume the step length $h = 0.1$. 5

Or

Given $\frac{dy}{dx} = -2xy^2$, $y(0) = 1$, compute $y(0.4)$ using Euler's method taking $h = 0.2$.

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