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4 SEM TDC MTMH (CBCS) C 8

2024

(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

1. *(a)* Define a flowchart. 1

(b) Write an algorithm to find the sum and product of two numbers. 2

(c) The number $x = 49 \cdot 67235$ is rounded off to four significant figures. Compute the absolute error and relative error. 1+1=2

2. *(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

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

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 $f(0 \cdot 5)$ 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.

(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 $h = 0 \cdot 5$. 5

Or

Use the midpoint rule to estimate

$$\int_{-0 \cdot 5}^{3 \cdot 5} \frac{x^3}{4} dx$$

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 $x = 1 \cdot 2$ for

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

assume the step length $h = 0 \cdot 1$. 5

Or

Given $\frac{dy}{dx} = -2xy^2$, $y(0) = 1$, compute $y(0 \cdot 4)$ using Euler's method taking $h = 0 \cdot 2$.

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