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4 SEM TDC MTMH (CBCS) C 8

2023

(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) Define an algorithm and write one important feature of an algorithm. 1+1=2
- (b) Define error and relative error. 1+1=2
- (c) Write the convergence of numerical methods. 1
2. (a) State true or false : 1
Iteration method is always convergent.
- (b) Describe bisection method for solving an algebraic equation. 4

(2)

Or

Find a real root of the equation

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

by secant method correct up to three decimal places.

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

Or

Determine the real root of $\cos x = 2x$ by Newton-Raphson method correct up to three decimal places.

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

Or

Solve the following by Gauss-Jordan method :

$$x + y + z = 5, 2x + 3y + 5z = 8, 4x + 5z = 2$$

- (b) Solve the following by Gauss-Jordan method : 5

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

Or

Find the solution of the system of equations

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

by Gauss-Seidel method up to three iterations.

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(Continued)

(3)

4. (a) Define interpolation. 1

- (b) Find the relation between D and Δ , where D = differential operator and Δ = forward difference operator. 2

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

$$x : 0 \quad 5 \quad 10 \quad 15 \quad 20 \\ y : 7 \quad 11 \quad 14 \quad 18 \quad 24$$

- (d) Deduce Newton's forward interpolation formula. 5

Or

Find the missing term in the following table using Lagrange's interpolation formula :

$$x : 0 \quad 1 \quad 2 \quad 3 \quad 4 \\ y : 1 \quad 3 \quad 9 \quad ? \quad 81$$

5. (a) Deduce composite Simpson's $\frac{1}{3}$ rd rule for numerical integration. 5

- (b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by trapezoidal rule. 5

Or

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

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(Turn Over)

- (c) Evaluate $\int_1^2 \frac{dx}{x}$ by Simpson's $\frac{3}{8}$ th rule. 5

Or

Evaluate $\int_{0.2}^{0.6} \frac{dx}{1+x}$ by Bool's rule correct to three decimal places, using $n = 4$.

6. (a) Find $y(0.10)$ and $y(0.15)$ by Euler's method from the equation

$$\frac{dy}{dx} = x^2 + y^2, \quad y(0) = 0$$

correct up to three decimal places, taking $h = 0.05$. 4

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

Or

Using Runge-Kutta method of fourth order, find the numerical solution at $x = 0.2$ for

$$\frac{dy}{dx} = 2x + y, \quad y(0) = 1$$

taking $h = 0.2$.
