B.Sc. - III (CBCS Pattern) Semester-VI

021C - (DSE-V) Mathematics Paper-I : Numerical Methods

P. Pages : 2 **GUG/W/24/13363**

Time : Three Hours * 5 0 8 3 * Max. Marks : 60

Notes : 1. Solve all **five** questions.
2. All questions carry equal marks.

UNIT – I

1. a) Find the positive root of the equation $x^3 - x - 2 = 0$ by the regula falsi method in five iterations. **6**

b) Show that the Newton-Raphson iteration for determining a square root of A has the form **6**

$$x_{n+1} = \frac{1}{2}\left(x_n + \frac{A}{x_n} \right).$$

Hence or otherwise find $\sqrt{3}$ correct to 9 decimal places.

OR

c) Use Gauss-Jordon method to solve the system **6**
$3x - y + 9z = 12,\ x + 2y + 3z = 4,\ 2x - 2y - z = 1.$

d) Obtain the triangular factorization of the matrix **6**

$$A = \begin{bmatrix} 2 & 0 & 1 \\ -1 & 3 & 1 \\ 1 & -1 & 2 \end{bmatrix}$$

UNIT – II

2. a) Construct the forward difference table for the following values of x and y: **6**

x :	0	1	2	3	4	5
y :	2	9	26	58	110	187

b) Express the polynomial $f(x) = x^3 - 2x^2 + 3x - 1$ into factorial polynomial and obtained their forward differences. **6**

OR

c) The following data gives the velocity v of a particle at time t. **6**

t :	0	1	4
v :	1	2	41

Use Lagrange interpolation formula to find its acceleration at the end of 4 second.

d) Find the third divided difference with arguments 2, 4, 9, 10 of the function **6**
$y = f(x) = x^3 - 2x.$

UNIT – III

3. a) Find the values of the derivatives $y'(x)$ at $x = 1.2$ from the following data: **6**

x :	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y :	2.7	3.4	4.1	5.2	6.3	7.6	8.9

b) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. **6**

t :	0	5	10	15	20
v :	0	10	70	180	340

Find the acceleration at t = 20 seconds.

OR

c) Find the maxima and minima of the function y = f(x) specified by the values: **6**

x :	–1	0	1	3	4
y =f(x) :	–4	3	–4	12	131

d) The following data gives the relation between steam pressure y and temperature x: **6**

x (temperature) :	140	150	160	170	185
y (pressure) :	4	5	6	8	11

Find the rate of change of pressure with respect to temperature when x = 180.

UNIT – IV

4. a) Derive the trapezoidal rule from Lagrange form of Newton-Cotes formula. **6**

b) Evaluate the integral $\int_0^2 e^{x^2} dx$ by Simpson's one-third rule. **6**

OR

c) Evaluate the integral $\int_0^4 \frac{dx}{1+x^2}$ by Boole's rule. **6**

d) Prove that the trapezoidal rule has degree of precision one. **6**

5. Solve **any six.**

a) Show that the Newton-Raphson iteration for determining a reciprocal root of A has the form $x_{n+1} = (2 - Ax_n)$. **2**

b) Define a triangular factorization. **2**

c) Prove that $E = 1 + \Delta$ **2**

d) Prove that $\mu = \frac{1}{2}\left(E^{\frac{1}{2}} + E^{-\frac{1}{2}} \right)$ **2**

e) Write the Newton general forward difference formula for first derivatives. **2**

f) Write the Newton divided difference formula for second derivatives. **2**

g) Define a degree of precision. **2**

h) Evaluate the integral $\int_0^6 \frac{dx}{1+x}$ by the trapezoidal rule. **2**

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