MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : BM-401

STATISTICS, NUMERICAL METHODS AND ALGORITHMS

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) The number of significant figures in 0.002560 is

   a) 6 b) 5

   c) 4 d) none of these.

   ii) Which of the following relations is true ?

   a) $E = 1 + \Delta$ b) $E = 1 - \Delta$

   c) $E = 1/\Delta$ d) None of these.

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iii) If $f(3) = 4$, $f(4) = 13$ and $f(6) = 43$, then $f(5) =$

a) 20 b) 26

c) 25 d) none of these.

iv) In Simpson's 1/3 rd rule for finding $\int_a^b f(x)dx$, $f(x)$ is approximated by

a) Line segment

b) Parabola

c) Circular sector

d) None of these.

v) In Guass elimination method, the given system of equations represented by AX=B is converted to another system UX=Y where U is

a) Diagonal matrix

b) Identity matrix

c) Upper triangular matrix

d) none of these.

vi) The Newton-Raphson's method fails when

a) $f'(x) = 1$ b) $f'(x) = 0$

c) $f'(x) = -1$ d) none of these.

vii) One of the roots of $x^3 - 17x + 5 = 0$ lies in between

a) 1 and 2 b) 0 and 1

c) −1 and 0 d) none of these.

viii) Runge-Kutta formula has a truncation error, which is of the order of

a) h^2 b) h^4

c) h^5 d) none of these.

ix) The percentage error in approximating $\frac{4}{3}$ to 1.3333 is

a) 0.0025% b) 25%

c) 0.00025% d) none of these.

x) Find the value of $\Delta^3 y$ from the following table.

x:	0	1	2	3
y:	3	6	11	18

a) 0 b) 3

c) 5 d) none of these.

xi) The degree of precision of Simpson's 1/3 rd rule is

a) 1 b) 3

c) 5 d) none of these.

xii) The Lagrange's interpolation polynomial of $f(x)$ is

x :	1	3	4
y :	4	12	19

a) $3x^2 - 12$ b) $x^2 - 12$

c) $x^2 - 4$ d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{1 - 0.162 \sin^2 \varphi}\, d\varphi$, by Simpson's one-third rule, correct up to two places of decimal, taking three points.

3. Find the root of $x^2 + 2x - 2 = 0$, by Newton-Raphson method, correct up to two significant figures.

4. Find the value of $f(2)$ from the following table :

x :	1	2	3	4	5
$f(x)$:	7	--	13	21	37.

5. Compute f (0.23) and f (0.29) using suitable formula from the table below :

x :	0.20	0.22	0.24	0.26	0.28	0.30
$f(x)$:	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

6. Given $\frac{dy}{dx}+\frac{y}{x}=\frac{1}{x^2}, y(1)=1$. Evaluate y (1.2) by modified Euler's method correct up to 4 decimal places.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. (a) Solve the system of linear equations by Guass Elimination method :

$$5x_1 - x_2 = 9$$
$$-x_1 + 5x_2 - x_3 = 4$$
$$-x_2 + 5x_3 = -6$$

b) Evaluate $\int_0^1 \frac{1}{x^2+1}$ using Simpson's 1/3 rd rule taking $n = 6$, hence find the value of π.

c) Prove that : $E^{-1} \equiv 1 - D$. 5 + 5 + 5

8. a) Find the value of $\sqrt{2}$ correct up to four significant figures from the following table :

x :	1.9	2.1	2.3	2.5	2.7
$f(x) = \sqrt{x}$	1.3784	1.4491	1.5166	1.5811	1.6432

b) Find the roots of the equation $x^3 - 4x + 1 = 0$ using Regula Falsi method.

c) $\int_0^1 e^x dx$ by Trapezoidal rule taking h=0.1. 5 + 5 + 5

9. a) Solve the following system of equations by L-U Factorization method :

$$x_1 + x_2 - x_3 = 2$$
$$2x_1 + 3x_2 + 5x_3 = -3$$
$$3x_1 + 2x_2 - 3x_3 = 6$$

b) Find the polynomial of the least degree which attains the prescribed values of the given points :

x :	0	1	2	3
y :	3	6	11	18

Hence find y for $x = 1.1$.

c) Using Newton-Raphson method, find a real root of the following equation correct to three decimal places $x^4 - x - 1 = 0$. 5 + 5 + 5

10. a) Using Runge-Kutta method of fourth order with h=0.1 find $y(1.1)$. Given $\frac{dy}{dx} = y^2 + xy, y(1) = 1$.

b) Using divided difference formula, evaluate $f(8)$.

x :	4	5	7	10	11	13
f(x) :	48	100	294	900	1210	2028

c) Solve the following system of equations by Gauss-Seidel iterative method :

$$x + y + 54z = 110$$
$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72.$$

5 + 5 + 5

11. a) Find A^{-1} where $A = \begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$.

b) Using Taylor's series method find y at $x = 1.1, 1.2$ solving $\frac{dy}{dx} = (x^2 + y^2)$ given by $y(1) = 2.3$.

c) Write down the general rules for rounding off a number to n significant figures. 6 + 6 + 3