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Following Paper ID and Roll No. to be filled in your Answer Book.

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B. Tech. Examination, 2024-25

(Even Semester)

STATISTICAL AND NUMERICAL TECHNIQUES

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION–A

1. Attempt all parts of the following : 8×1=8

   (a) Write the regression line of y on x.

   (b) Write the control limits for mean chart.

   (c) Define absolute error.

   (d) Write the order of convergence of bisection method.

   (e) Write the relation between Δ and E. where the symbols have their usual meaning.

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(f) Write the Lagrange's formula for unequal intervals.

(g) Write the trapezoidal rule.

(h) Write the Euler's formula for first order differential equation.

SECTION–B

2. Attempt any two parts of the following : 2×6=12

(a) From the given data find the equation of lines of regression of x on y and y on x. Also calculate the correlation coefficient :

x	2	4	6	8	10
y	5	7	9	8	11

(b) Find a root of the equation $x^3 - 4x - 9 = 0$ by using bisection method upto three decimal places.

(c) Use Newton's divided difference formula to calculate f(x) interpolating polynomial :

x	–1	0	2	3	7	10
f(x)	–11	1	1	1	141	561

(d) Perform two iterations of Picard's method to find an approximate solution of the initial value problem $y^1 = x + y^2$; $y(0) = 1$.

SECTION – C

Note :– Attempt all questions. Attempt any two parts from each questions. 8×5=40

3. (a) Calculate Karl Pearson's coefficient of correlation for the data given below :

x	3	7	5	4	6	8	2	7
y	7	12	8	8	10	13	5	10

(b) Construct p-chart from the following data :

No. of sample (each of 100 items)	1	2	3	4	5	6	7	8	9	10
No. of defectives	12	10	6	8	9	9	7	10	11	8

(c) The following table gives a classification of a sample of 160 plants of their flower colour and flatness of leaf :

	Flat leaves	Colourd leaves	Total
White flower	99	36	135
Red flower	20	5	25
Total	119	41	160

Test whether the flower colour is independent of the flatness of the leaf (critical value of the table value of X^2 at $\alpha = 0.05$ for 1 d.f. is 3.841).

4. (a) Find the smallest positive root of $x^3 - 5x + 3 = 0$ by using Newton's Raphson method.

(b) Solve the system of equation by using Gauss elimination method :

$$x - 2y + 9z = 8$$
$$2x - 8y + z = -5$$
$$3x + y - z = 3$$

(c) Solve the system of equation by using Gauss-Seidel method :

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

5. (a) Given that :

x	0	1	2	3	4
f (x)	1	1	7	25	61

find $f'(1)$.

(b) Given the data $f(1) = 4$, $f(2) = 5$, $f(7) = 5$, $f(8) = 4$ compute $f(6)$ using Lagrange's interpolation formula.

(c) By using Simpson's $\left(\frac{1}{3}\right)$ rule, show that :

$$\int_0^1 \frac{dx}{1+x} = \log_e 2 = 0.69315$$

6. (a) Apply Runge-Kutta method of fourth order to solve :

$$10\frac{dy}{dx} = x^2 + y^2;\ y(0) = 1 \text{ for } x = 0.1$$

(b) The following table gives the sample means and ranges for I. Q. samples each of size 6, in the production of certain component. Construct the central chart for mean and range and comment on the nature of control.

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Sample No.	Mean $\bar{X}$	Range R
1	37.5	9.5
2	49.8	12.8
3	51.5	10.0
4	59.2	9.1
5	54.7	7.8
6	34.7	5.8
7	51.4	14.5
8	61.4	2.8
9	70.7	3.7
10	75.3	8.0

From the table of control chart, for sample size of 6 $A_2 = 0.483$, $D_3 = 0$, $D_4 = 2.004$.

(c) Using Lagrange's interpolation formula, find the value of y corresponding to x = 10 from the following data :

x	5	6	9	11
y	12	13	14	16

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