

[Time:2.30 Hrs]

[ Marks:75 ]

Please check whether you have got the right question paper.

- N.B:
1. All question are compulsory.
  2. Figures to the right indicate full marks.
  3. Students answering in the regional language should refer in case of doubt to the main text of the paper in English.

Q.1 Attempt **any three** of the following:

15

- A) Derive the Maclaurin series of  $\sin(x) = x - x^3/3! + x^5/5! - x^7/7! + \dots$
- B) To travel 900 kms if 60 litres of petrol is required. How much petrol is needed to go to a place which is 300 kms away?
- C) An approximate value of  $\pi$  is given by 3.1428571 and its true value is 3.1415926. Find the absolute and relative errors.
- D) Round-off the number 75462 to four significant digits and then calculate the percentage error.
- E) Show that  $a(b-c) \neq ab-ac$  ( upto 4 decimals)
- F) Explain the difference between Accuracy and Precision.

Q.2 Attempt **any three** of the following:

15

- A) Using bisection method, find the approximate value of  $\sqrt{10}$  by performing two iterations.
- B) Solve the equation  $x^3 - 4x - 9 = 0$  using Newton-Raphson method (perform two iterations).
- C) Find a real root of the equation  $x^3 - 5x + 1$  lies in the interval (0, 1). Perform four iterations of the secant method.

D) Given

x	1	2	3	4	5	6	7	8
F(x)	0.01	0.004	0.02	0.12	0.15	0.257	0.325	0.231

Find  $f(7.5)$  using Newton's backward interpolation formula.

- E) Find the root of the equation  $x^3 + 2x^2 + 2.2x + 0.4 = 0$  which lies between -1 and 0 correct up to 4 decimals using Regula-Falsi Method.

Given that  $y_0=4, y_1=3, y_2=4, y_3=10$  and  $y_4=24$ . Find the value of  $\Delta^4 y_0$ .

- F)
  - i. By using Difference Table
  - ii. Without using Difference Table.

Q.3 Attempt **any three** of the following: 15

A) Solve the system  $6x + y + z = 20$ ,  $x + 4y - z = 6$ ,  $x - y + 5z = 7$  using Gauss-Jordan Method

B) Solve the following system using Gauss Seidal iteration method.

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

$$x_1 + 3x_2 - 2x_3 = 7$$

$$x_1 + 2x_2 + 3x_3 = 10$$

C) For the following table obtain  $dy/dx$  and  $d^2y/dx^2$  at  $x=6$

X	4.5	5	5.5	6.0	6.5	7.0	7.5
Y	9.69	12.90	16.71	21.18	26.37	32.34	39.15

D) Use Trapezoidal rule to evaluate  $\int_0^1 x^3 dx$  considering five subintervals.

E) Using Taylor's series method of the fourth order, find  $y$  at  $x=1.1$  and  $1.2$ , by Solving the equation  $\frac{dy}{dx} = x^2 + y^2$ ;  $y(1)=2$

F) Solve  $\frac{dy}{dx} = 1 + y^2$ ;  $y(0)=0$ . Find  $y(0.1), y(0.2), y(0.3)$  using Euler's method.

Q.4 Attempt **any three** of the following: 15

A) What is Scatter Diagram? Write merits and demerits.

B) Find the Coefficient of correlation for the following data and comment on its value

x	6	13	9	10	6	4
y	2	15	17	13	7	6

C) From the given data calculate equations of two lines of regression

	Mean	Standard deviation
x	20	3
y	100	12

Coefficient of correlation is 0.8 i.e. ( $r = 0.8$ )

D) Diet for a sick person must contain at least 400 units of vitamins, 500 units of minerals and 300 calories. Two foods  $F_1$  and  $F_2$  cost Rs. 2 and Rs. 4 per unit respectively. Each unit of food  $F_1$  contains 10 units of vitamins, 20 unit of minerals and 15 calories, whereas each unit of food  $F_2$  contains 25 units of vitamins, 10 units of minerals and 20 calories. Formulate the L.P.P. to satisfy sick person's requirement at minimum cost.

- E) Solve the following LPP graphically,  
 Minimize  $z=25x + 10y$   
 Subject to,  $10x+2y \geq 20$   
 $x+2y \geq 6, \quad x \geq 0, y \geq 0$

- F) Using method of least square fit a second degree parabola for the following data.

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	9

Q.5 Attempt **any three** of the following: 15

- A) Define discrete random variable and Continuous random variable. Distinction between continuous random variable and discrete random variable:
- B) A random variable is sum of the numbers that appear when a pair of dice is rolled. Find probability distribution of the random variable.
- C) A pair of fair dice is thrown and sum of numbers on the uppermost faces is noted. Find its probability distribution (p.m.f.).
- D) A random variable has the following probability distribution

Value of X	0	1	2	3	4	5	6	7	8
P(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

- i. Determine the value of a  
 ii. Find (i)  $P(x < 3)$  (ii)  $P(x \leq 3)$  (iii)  $P(x > 7)$   
 iii. Find the cumulative distribution function of x.
- E) If 2% of electric bulbs manufactured by a certain company are defective. Find the probability that in a sample of 200 bulbs i) less than 2 bulbs ii) more than 3 bulbs are defective. [ $e^{-4} = 0.0183$ ]
- F) The life time in hours of a certain electric component follows exponential distribution with distribution function.  
 $F(x) = 1 - e^{-0.004x} \quad ; x \geq 0$   
 i) What is the probability that the component will survive 200 hours?  
 ii) What is the probability that it will fail during 250 to 350 hours?  
 iii) What is the expected life time of the component?