[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 5443 **D** **Your Roll No................**

Unique Paper Code : 235651

Name of the Course : **B.A. (Prog.)**

Name of the Paper : Numerical Analysis and Statistics

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper has **six** questions in all.
3. Attempt any **two** parts from each question.
4. **All** questions are compulsory.
5. Use of scientific calculator is allowed.

1\. (a) The smallest positive root of the following equation is to be obtained

$$f(x) = 3x^3 + 10x^2 + 10x + 7 = 0$$

(i) Find an interval of unit length which contains the root.

(ii) Perform two iterations of the bisection method.

(iii) Taking the end points of the last interval as initial approximations, perform three iterations of the secant method. (6)

(b) Using Newton-Raphson method obtain the approximate value of 1/N where N = 18. Find the result correct to two decimal places. (6)

(c) For the equation $x^4 - x - 10 = 0$, determine the interval of unit length to find the smallest positive root. Use this to find the root correct to two decimal places using the Regula-Falsi method. (6)

2. (a) Find the necessary and sufficient conditions on k, so that the (i) Jacobi method, (ii) Gauss-seidel method converge for solving the system of equations

$Ax = b$, where $A = \begin{bmatrix} 1 & 0 & k \\ 2 & 1 & 3 \\ k & 0 & 1 \end{bmatrix}$ and b is arbitrary. (6)

(b) Solve the following system of equations

$$\begin{bmatrix} 2 & 1 & 1 & 2 \\ 4 & 0 & 2 & 1 \\ 3 & 2 & 2 & 0 \\ 1 & 3 & 2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \\ -1 \\ -4 \end{bmatrix}$$

Using the Gauss elimination method with partial pivoting. (6)

(c) Jacobi iteration scheme is used to solve the system of equations

$$2x - y = 1$$

$$-x + 2y - z = 0$$

$$-y + 2z - w = 0$$

$$-z + 2w = 1$$

Starting with $x^{(0)} = [0.5, 0.5, 0.5, 0.5]^T$, iterate 3 times. (6)

3. (a) Construct the divided difference table for the data

x	0.5	1.5	3.0	5.0	6.5	8.0
f(x)	1.625	5.875	31.0	131.0	282.125	521.0

Hence, find the interpolating polynomial and an approximation to the value of f(2). (6½)

(b) For the following data $p(1) = 1$, $p(3) = 27$, $p(4) = 64$.

Obtain the polynomial using Lagrange interpolating formula. Estimate p(2). (6½)

(c) If $f(x) = 1/x^2$, find the divided difference $f[x_1, x_2, x_3, x_4]$. (6½)

4. (a) Write a short note on skewness and kurtosis. (6)

(b) Fit a straight line to the following data

X	1	2	3	4	6	8
Y	2.4	3	3.6	4	5	6

(6)

(c) The ranks of 16 students in Mathematics (X) and Physics (Y) are as follows :

X	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Y	1	10	3	4	5	7	2	6	8	11	15	9	14	12	16	13

Calculate the rank correlation coefficient. (6)

5. (a) Consider the experiment of tossing two dice. Let X denotes the total of the two dice. Find E[X] and Var[X]. (6½)

(b) For the following frequency distribution

$$f(x) = \begin{cases} \frac{2x}{9}, & 0 \le x \le 3 \\ 0, & \text{elsewhere} \end{cases}$$

find the mean and the standard deviation. (6½)

(c) Let X be a random variable and c a constant. Show that

$E[(X-c)^2] = Var[X] + (E[X]-c)^2$ (6½)

6. (a) If X has a Binomial distribution with parameters n and p then

$E[X] = np$, $Var[X] = npq$ and

$M_x(t) = (q+pe^t)^n$ (6½)

(b) If X is a poisson variate such that

$p[X=2] = 9p[x=4] + 90p[X=6]$

find λ, the mean of X and the variance of X. (6½)

(c) Find the mode of the normal distribution. (6½)