Con. 3131–11.                                                           RK–1962

(3 Hours)                                          [Total Marks : 100]

N.B. :  (1)  Question No. **1** is **compulsory**.
   (2)  Attempt any **four** questions from the remaining **six** questions.
   (3)  **Statistical tables** will be provided on **request**.

1. (a)  A sample of 100 students is taken from a large population, the mean heights   5
       of students in this sample is 160 cm. Can it be reasonably regarded that is
       the population, the mean height is 165 cm and standard deviation 10 cm.

   (b)  If $f(1) = 4$, $f(2) = 4$, $f(7) = 5$ and $f(8) = 4$. Find $f(5)$ using Lagrange's interpolation   5
       formula.

   (c)  The lifetime of a certain brand of electric bulb may be considered a random   5
       variable with mean 1200 hrs. and standard deviation 250 hrs. Using central
       limit theorem, find the probability that the average life time of 60 bulbs exceeds
       1250 hrs.

   (d)  Define the terms : (i) Feasible Solution  (ii) Optimal Solution  (iii) Basic and   5
       Non Basic variables  (iv) Basic Feasible solution  (v) Degenerate Basic Feasible
       solution.

2. (a)  The first four moments of a distribution about the value 4 of a variable are   6
       $-1{\cdot}5$, 17, $-30$ and 108. Find the first four central moments.

   (b)  Solve using Gauss Jordan Method –                                          6
           $2x + y + 4z = 16$
           $3x + 2y + z = 10$
           $x + 3y + 3z = 16$

   (c)  In a distribution exactly normal 7% of items are under 35 and 89% of the items   8
       are under 63. Find probability of items lies between 45 and 55.

3. (a) A certain injection administered to each of the 12 patients resulted in the following **6** increase of blood pressure :–

   5, 2, 8, –1, 3, 0, 6, –2, 1, 5, 0, 4.

   Can it be concluded that the injection will be in general accompanied by an increase in B.P ?

   (b) Maximize : $z = x_1 - 2x_2 + 4x_3$ **6**

   Subject to $x_1 + 2x_2 + 3x_3 = 7$

   $3x_1 + 4x_2 + 6x_3 = 15$

   Find all basic solutions to the above problem.

   (c) Fit a Poisson distribution to the following data and test goodness of fit :– **8**

   | x | 0 | 1 | 2 | 3 | 4 | 5 |
   |---|---|---|---|---|---|---|
   | f | 142 | 156 | 69 | 27 | 5 | 1 |

4. (a) Find a root of $x^3 - x - 4 = 0$ using Bisection method. **6**

   (b) A car hire firm has two cars which it hires out day by day. The number of demands **6** for a car on each day is distributed as Poisson variate with mean 1·5. Calculated the proportion of days on which (i) neither car is used (ii) some demand is refused.

   (c) Evaluate : $\int_0^1 \frac{dx}{1+x}$ by using (i) Trapezoidal rule (ii) Simpson's $\left(\frac{1}{3}\right)^{rd}$ Rule **8**

   (iii) Simpson's $\left(\frac{3}{8}\right)^{th}$. Rule Take h = 0·25.

   Compare the results with exact value.

   **[TURN OVER**

5.  (a)  If on an average one ship in every 10 is wrecked. Find probability that out of     6
        5 ships expected to arrive, 4 at least will arrive safely.

    (b)  Solve using Guass Seidal Method –                                                  6

$$6x + 3y + 12z = 35$$
$$8x - 3y + 2z = 20$$
$$4x + 11y - x = 33$$

        Correct to 3 decimal places.

    (c)  The following marks have been obtained by a class of students in Stats (out        8
        of 100) :–

| Paper I  | 45 | 55 | 56 | 58 | 60 | 65 | 68 | 70 | 75 | 80 | 85 |
|----------|----|----|----|----|----|----|----|----|----|----|----|
| Paper II | 56 | 50 | 48 | 60 | 62 | 64 | 65 | 70 | 74 | 82 | 90 |

        Find the equations of lines of regression.

6.  (a)  Two batches of 12 animals are taken for inoculation. The numbers of dead           6
        and serving animals are given. Can the inoculation be regarded as effective
        against the disease at 5% level of significance ?

|                | Dead | Survived |
|----------------|------|----------|
| Inoculated     | 2    | 10       |
| Non-Inoculated | 8    | 4        |

    (b)  Find cube root of 15 by Newton Raphson's method upto four places of decimal.        6

    (c)  The diameter say X of an electric cable is assumed to be a continuous random        8
        variable with p.d.f. ; $f(x) = 6x (1 - x)$ ; $0 \le x \le 1$.

        (i)  Is it probability distribution function ?

        (ii) Obtain cummulative distribution function.

        (iii) Compute $P\left\{ X \le \frac{1}{2} \middle/ \frac{1}{3} \le X \le \frac{2}{3} \right\}$

        (iv) Determine K, so that $P(X < K) = P(X > K)$.

7.  (a)  Using Newton's difference formula find $f(4{\cdot}4)$ from the table –             6

| x    | 0  | 2 | 4 | 6 | 8  | 10 | 12 |
|------|----|---|---|---|----|----|----|
| f(x) | 12 | 7 | 6 | 7 | 13 | 32 | 77 |

    (b)  Fit a straight line to the following data –                                         6

| x | 1  | 2  | 3  | 4  | 5  | 6  |
|---|----|----|----|----|----|----|
| y | 49 | 54 | 60 | 73 | 80 | 86 |

    (c)  Using Simplex method solve the following L.P.P. :–                                  8

        Maximize :    $z = 3x_1 + 2x_2$
        Subject to :    $x_1 + x_2 \le 4$
                        $x_1 - x_2 \le 2$
                        $x_1, x_2 \ge 0$