Name of Course	: **B.A.(Prog.) DSE : Mathematics**
Unique Paper Code	: **62357503**
Name of Paper	: **DSC- Statistics**
Semester	: **V**
Duration	: **3 hours**
Maximum Marks	: **75 Marks**

Attempt any four questions. All questions carry equal marks.

1. A box in a certain supply room contains four 40-W lightbulbs, five 60-W bulbs, and six 75-W bulbs.

    i. Suppose that three bulbs are randomly selected. What is the probability that exactly two of the selected bulbs are rated 75 W?

    ii. If two bulbs are randomly selected from the box of lightbulbs and at least one of them is found to be rated 75 W, what is the probability that both of them are 75-W bulbs?

    iii. Given that at least one of the two selected is not rated 75 W, what is the probability that both selected bulbs have the same rating?

   Suppose A and B are independent events. Show that the following pairs of events are also independent:

    i. A and $\bar{B}$

    ii. $\bar{A}$ and $\bar{B}$

2. Evaluate the first four moments about the mean for the random variable with probability density function

$$f(x) = \begin{cases} \dfrac{4x}{81}(9 - x^2), & 0 \le x \le 3 \\ 0, & elsewhere \end{cases}$$

   A and B throw with one die for a prize of Rs. 11 which is to be won by the player who first throws 6. If A has the first throw, what are their respective expectations?

3. Suppose that flaws in plywood occur at random with an average of one flaw per 50 square feet. What is the probability that a 4×8 square feet sheet will

    i. have no flaws

ii.   atmost one flaw

(Assume that number of flaws per unit area is Poison distributed.)

Suppose that a trainee soldier shoots a target in an independent manner. If the probability that the target is hit on any one shot is 0.8, what is the probability that the target would be hit

i.   on the sixth attempt

ii.   in fewer than 5 shots

iii.   in even number of shots.

4. Consider a sample of size 2 drawn without replacement from an urn containing three balls numbered 1, 2 and 3. let X be the number on the first ball drawn and Y the larger of the two numbers drawn.

i.   Find the joint discrete density function of X and Y

ii. $P(X = 1/Y = 3)$

iii.   Find the correlation coefficient of X and Y

The joint probability density function of X and Y is given by

$$f(x,y) = \begin{cases} \dfrac{x+y}{3} & 0 \le x \le 1, 0 \le y \le 2 \\ 0 & elsewhere \end{cases}$$

Find the two lines of regression.

5. Let $(X_k), k = 1,2, \ldots \ldots$ be a sequence of independent random variables defined as

$P\left(X_k = \dfrac{1}{\sqrt{k}}\right) = \dfrac{2}{3}$ and $P\left(X_k = -\dfrac{1}{\sqrt{k}}\right) = \dfrac{1}{3}$.

Examine if the Weak Law of Large Numbers holds for this sequence.

Two independent samples of 8 and 7 items respectively have the following values of the variables:

Sample 1: 9   11 13 11 15 9 12 14

Sample 2: 10 12 10 14 9 8 10

Do the two estimates of population variance differ significantly? Given that for (7,6) degrees of freedom the value of F at 5% level of significance is 4.21.

6. In a random sample of 500 men from a particular district of UP, 300 are found to be smokers. In one of 1000 men from another district, 550 are smokers. Do the data indicate that the two districts are significantly different with respect to the prevalence of smoking among the men.

In experiments on pea-breeding, Mendel got the following frequencies of seeds: 315 round and yellow, 101 wrinkled and yellow, 108 round and green, 32 wrinkled and green: total 556. Theory predicts that the frequencies should be in the proportion 9:3:3:1. Examine the correspondence between theory and experiment. (chi-square at 3 degrees of freedom at 5% level of significance is 7.815)