

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN  
(AUTONOMOUS)

(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)  
Chromepet, Chennai - 600 044.

B.Sc.Statistics - END SEMESTER EXAMINATIONS - APRIL 2025

SEMESTER - I

**20USTCT1002 - Probability and Random Variables**

Total Duration : 2 Hrs.30 Mins.

Total Marks : 60

**Section B**

Answer any **SIX** questions ( $6 \times 5 = 30$  Marks)

1. Define the classical and axiomatic approach to probability.
2. State and prove the multiplication theorem for two events.
3. Let  $X$  be a random variable with the following probability distribution

<b>x:</b>	-3	6	9
<b>P(x):</b>	1/6	1/2	1/3

4. If  $X$  and  $Y$  are random variables then show that  $E(X + Y) = E(X) + E(Y)$ .
5. Explain the property of effect of change of origin and scale on characteristic function.

6. A random variable  $X$  has the p.d.f  $f(x) = \begin{cases} 3x^2, & 0 \leq x \leq 1 \\ 0, & \text{Otherwise} \end{cases}$

Compute  $a$  and  $b$  such that (i)  $P(X \leq a) = P(X > a)$  (ii)  $P(X > b) = 0.05$

7. If  $B \subset A$  then show that

$$i. P(A \cap \bar{B}) = P(A) - P(B) \quad P(B) \leq P(A).$$

8. The odds that person  $X$  speaks the truth are 3:2 and the odds that the person  $Y$  speaks the truth are 5:3. Determine the percentage of cases are they likely to contradict each other on an identical point.

**Section C**

Answer any **THREE** questions ( $3 \times 10 = 30$  Marks)

9. State and prove Boole's Inequality.
10. The chances that doctor  $A$  will diagnose a disease  $X$  correctly is 60%. The chances that a patient will die by his treatment after correct diagnosis is 40% and the chance of death by wrong diagnosis is 70%. A patient of doctor  $A$ , who had disease  $X$  died. Determine the chance that his disease was diagnosed correctly?

**Contd...**

11. A two dimensional random variable has the j.p.d.f given by

$$f(x, y) = \begin{cases} 6x2y, & 0 < x < 1, 0 < y < 1 \\ 0, & \text{Otherwise} \end{cases}$$

(i) Verify that it is a j.p.d.f.

(ii) Compute  $P(0 < x < 3/4, 1/3 < y < 2)$ ,  $P(x < 1/y < 2)$ ,  $P(x + y < 1)$

12. State and prove Chebyshev's Inequality.

13. Justify the properties of Moment generating function.

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