



A Charutar Vidya Mandal's Institution
V.P. & R.P.T.P. SCIENCE COLLEGE
(AUTONOMOUS) (Grant-in-Aid)
Affiliated to Sardar Patel University
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Bachelor of Science (Semester - IV) External Examination - 2026
US04MISTA01 (ELEMENTS OF PROBABILITY THEORY)

Date: 27/03/2026 (Friday)

Time: 1.45 to 3.15 PM (1.5 HRS.)

Total marks: 25

Note: Q.2 and Q.3 carries 10 marks

Q.1 Write the most appropriate answer from the following multiple-choice questions. (05)

(1) The value of $k =$ _____ if

x	1	2	3	4	5	6
$F(x)$	k	$4k$	$9k$	$16k$	$25k$	$36k$

- (a) $1/91$ (b) $1/36$ (c) $4/36$ (d) $3/36$
- (2) A box contains 3 red, 3 blue and 4 green balls. Two balls are drawn with replacement. The probability that both balls drawn are of different colours is
(a) $9/25$ (b) $16/25$ (c) $13/25$ (d) None of these
- (3) If $P(A/B) = 1$, then
(a) A and B are mutually exclusive (b) $B \subset A$ (c) $A \subset B$ (d) $A = B$
- (4) A r.v. X has p.d.f. $f(x) = 1/4, 0 < x < 4$ and zero otherwise, then $P(|X| > 1) =$ _____
(a) $1/2$ (b) 1 (c) $2/3$ (d) $3/4$

(5) A r.v. X has pdf $f(x) = \begin{cases} kx^2, 0 \leq x \leq 1 \\ k(2-x), 1 \leq x \leq 2 \\ 0, \text{otherwise} \end{cases}$

$P(0.5 < X < 1.5) =$ _____
(a) $3/5$ (b) $2/5$ (c) $1/2$ (d) None of these

Q.2 (a) Do as directed:

- (i) If A and B are two independent events then prove that A' and B' are also independent.
(ii) For two events A and B , Prove that $P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$

(b) The three bags containing different colours of balls are as follows:

Bag - I	Bag - II	Bag - III
4 white	2 white	5 white
2 black	3 black	2 black

A bag is chosen at random and two balls are drawn.

- (i) What is the prob. that the selected balls are of same colour?
(ii) What is the prob. that they come from bag - II?

OR

Q.2 (a) Let A and B are two independent events with $P(A) > P(B)$. If $P(A \cap B) = 6/25$ and $P(A/B) + P(B/A) = 1$ then find $P(A)$ and $P(B)$.

(b) A bag contains 3 red, 6 white and 4 black balls from which three balls are drawn at random. What is the prob. that drawn balls are (i) of same colours (ii) exactly one black ball (iii) the first two balls are of the same colour (iv) at least two red balls.

Q.3 (a) A coin is tossed repeatedly until a head appears for the first time.

[5]

1. Describe the sample space of the experiment.
2. Let X be the number of tosses required to obtain the first head. State whether X is a discrete or continuous random variable with justification.
3. Find the probability distribution of X .

(b) $f(x) = kx^2, 0 < x < 1$

[5]

$= 0$, otherwise, is the p.d.f. of a r.v. X . (i) Determine the value of k (ii) find 'c' and 'd' such that (a) $P(X > c) = 0.25$ (b) $P(X \leq d) = P(X \geq d)$.

OR

Q.3 (a) (i) Let X be a r.v. with prob. distribution $f(x) = \frac{2}{3^x}, x = 1, 2, 3, \dots$ and zero otherwise. Find the prob. that X is odd.

[5]

(ii) The pdf of a r.v. X is $f(x) = \begin{cases} x/3, & 0 \leq x < 1 \\ (5/27)(4-x), & 1 \leq x < 4 \\ 0, & \text{otherwise} \end{cases}$

Find (a) $P(X > 2)$ (b) $P(X < 1/3)$

(b) Two dice are rolled. Let X be the smaller of two numbers.

[5]

1. Is X discrete or continuous r.v.?
2. Find the probability distribution of X
3. Find (a) $P(X \geq 4)$ (b) $P(2 \leq X \leq 5)$ (c) $P(X < 3)$

