

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION MO/2025)

CLASS: B.Sc.  
BRANCH: Chemistry

SEMESTER : III  
SESSION: MO/2025

SUBJECT: ED107 PROBABILITY I

TIME: 02 Hours

FULL MARKS: 25

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates.
  5. All the notations used in the question paper have usual meanings.
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- |     |   |       | CO  | BL |
|-----|---|-------|-----|----|
| Q.1 | Three fair coins are tossed. Consider the events: $A$ : "at least two heads occur" and $B$ : "first coin shows head".<br>a. Are $A$ and $B$ mutually exclusive events?<br>b. Are $A$ and $B$ mutually independent events?<br>Justify your answer mathematically.  | [2+3] | CO1 | 1  |
| Q.2 | Let $(\Omega, S, P)$ be a probability space. Let $A, B \in S$ . If $A$ and $B$ are independent events, then show that $A^c$ and $B$ are independent.  | [5]   | CO1 | 1  |
| Q.3 | Suppose that all 4 men at a party throw their hats in the centre of a room. Then each man randomly selects a hat. What is the probability that none of the 4 men selects his own hat?   | [5]   | CO1 | 2  |
| Q.4 | Box 1 contains two white, and three black balls and Box 2 contains two black and one white ball. A die is rolled. If 1, 2, 3, or 4 shows up, Box 1 is selected; otherwise, Box 2 is selected. A ball is then drawn at random from the selected box. Let $A$ be the event that the ball drawn is white. If $U, V$ respectively, denote the events that the box selected is 1, 2 then<br>a. What is the probability of $A$ ?<br>b. What is the conditional probability $P(U A)$ ? | [3+2] | CO2 | 3  |
| Q.5 | Let $\Omega = \{HH, TT, HT, TH\}$ be a sample space. A function $X$ on $\Omega$ is defined by $X(\omega) =$ number of $H$ 's in $\omega \in \Omega$ . Check whether $X$ is a random variable or not.  | [5]   | CO2 | 3  |

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