PROBABILITY

☑ **Probability formula :** $$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

☑ **Outcomes space :** A possible result of a random experiment is called its outcome.

☑ **Sample space :** The set of outcomes is called the sample space of the experiment.

☑ **Sample point :** Each element of the sample space is called a sample point.

☑ **Event :** Any subset E of a sample space S is called an event.

☑ **Types of events**

1. **Impossible Events and Sure Events :** The empty set ϕ Impossible Events. The whole sample space S Sure Events
2. **Simple Event :** If any event E has only one sample point of a sample space, it is called a Simple event. (Elementary Event)
3. **Compound Event :** If an event has more than one sample point, it is called a compound event.

☑ **Algebra of events**

1. **Complementary Event of A :** The Set A' or $S - A$
2. **The Event 'A' or 'B' :** The set $A \cup B$
3. **The Event 'A' and 'B' :** The set $A \cap B$
4. **The Event 'A' but not 'B' :** The set $A - B$

☑ **Mutually exclusive events :** A and B are mutually exclusive if $A \cap B = \phi$

Note : Simple events of a sample space are always mutually exclusive.

☑ **Exhaustive Events :** If $E_1, E_2, \ldots, E_n$ are n events of a sample space S and if $E_1 \cup E_2 \cup \ldots \cup E_n = \bigcup_{i=1}^{n} E_i = S$ then $E_1, E_2, \ldots, E_n$ are called exhaustive events.

☑ **Probability :** Number $P(\omega_i)$ associated with sample point ω_i such that

(i) $0 \le P(\omega_i) \le 1$ (ii) $\sum P(\omega_i)$ for all $\omega_i \in S = 1$ (iii) $P(A) = \sum P(\omega_i)$ for all $\omega_i \in A$

The no. of $P(\omega_i)$ is called probability of the outcome ω_i.

☑ **Equally likes outcomes :** All outcomes with equal probability

☑ **Probability of an event :** For a finite sample space with equally likely outcomes.

$$P(A) = \frac{n(A)}{n(S)}$$ (n(A): number of elements in the set A; n(S): number of elements in the set S)

☑ If A and B are any two events, then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

☑ If A and B are mutually exclusive, then $P(A \cup B) = P(A) + P(B)$

☑ If A is any event then $P(\text{not } A) = 1 - P(A)$

☑ **Conditional Probability :** If E and F are two events with the same space of a random experiment, then the conditional Probability of the event E gives that F has occured i.e.

$$P\left(\frac{E}{F}\right) = \frac{P(E \cap F)}{P(F)}, \text{ provided } P(F) \neq 0$$

☑ **Probability of Conditional Probability**

1. $P\left(\frac{S}{F}\right) = P\left(\frac{F}{F}\right) = 1$
2. If A and B are two events in a sample space S and F is an event of S, such that $P(F) \neq 0$ then; $P\left(\frac{A \cup B}{F}\right) = P\left(\frac{A}{F}\right) + P\left(\frac{B}{F}\right) - P\left(\frac{A \cap B}{F}\right)$
3. $P\left(\frac{E'}{F}\right) = 1 - P\left(\frac{E}{F}\right)$