Class 11

Important Formulas

Probability

1. An experiment whose outcomes cannot be predicted or determined in advance is called a random experiment.
2. Each outcome of a random experiment is known as an elementary event.
3. The set of all possible outcomes (elementary events) of a random experiment is called the sample space associated with it.
4. A subset of the sample space associated with a random experiment is called an event.
5. An event is said to occur if any one of the elementary events belonging to it is an outcome.
6. An event associated with a random experiment is called a certain event if it always occurs whenever the experiment is performed.
   The sample space associated with a random experiment defines a certain event.
7. The null set of the sample space defines an impossible event.
8. An event associated with a random experiment is a compound event, if it is the disjoint union of two or more elementary events.
9. Two or more events associated with a random experiment are said to be mutually exclusive or incompatible events if the occurrence of any one of them prevents the occurrence of all others i.e. no two or more of them can occur simultaneously in the same trial.
   If A and B are mutually exclusive events, then $A \cap B = \phi$.
10. Events $A_1, A_2, A_3, \ldots, A_n$ associated with a random experiment with sample space S are exhaustive if $A_1 \cup A_2 \cup \ldots \cup A_n = S$.
11. Let S be the sample space associated with a random experiment. A set of events $A_1, A_2, \ldots, A_n$ is said to form a set of mutually exclusive and exhaustive system of events if
    (i) $A_1 \cup A_2 \cup \ldots \cup A_n = S$ (ii) $A_i \cap A_j = \phi$ for $i \neq j$
12. *Probability function:* Let $S = \{w_1, w_2, \ldots, w_n\}$ be the sample space associated with a random experiment. Then a function P which assigns every event $A \subset S$ to a unique non-negative real number $P(A)$ is called the probability function if the following axioms hold :
    A - 1 : $0 \leq P(w_i) \leq 1$ for all $w_i \in S$
    A - 2 : $P(S) = 1$ i.e. $P(w_1) + P(w_2) + \ldots + P(w_n) = 1$
    A - 3 : For any event $A \subset S$, $P(A) = \sum_{w_k \in A} P(w_k)$, the number $P(w_k)$ is called probability of elementary event w_k.
13. *Probability of an event:* If there are n elementary events associated with a random experiment and m of them are favourable to an event A, then the probability of occurrence of A is defined as:
    $$P(A) = \frac{m}{n} = \frac{\text{Favourable number of elementary events}}{\text{Total number of elementary events}}$$
    The odds in favour of occurrence of the event A are defined by $m : (n - m)$
    The odds against the occurrence of A are defined by $(n - m) : m$.
    The probability of non-occurrence of A is given by $P(\bar{A}) = 1 - P(A)$.

14. If A and B are two events associated with a random experiment, then
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
If A and B are mutually exclusive events, then $P(A \cup B) = P(A) + P(B)$.

15. If A, B, C are three events associated with a random experiment, then
$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C$$

16. If A and B are two events associated with a random experiment, then
(i) $P(\bar{A} \cap B) = P(B) - P(A \cap B)$ i.e. probability of occurrence of B only $= P(B) - P(A \cap B)$
(ii) $P(A \cap \bar{B}) = P(A) - P(A \cap B)$ i.e. probability of occurrence of A only $= P(A) - P(A \cap B)$
(iii) Probability of occurrence of exactly one of A and B is $P(A) + P(B) - 2P(A \cap B)$
$= P(A \cup B) - P(A \cap B)$