9. PROBABILITY

(2 x 4) + (1 x 7) = 15 Marks

IMP FORMULAS, KEY CONCEPTS

1.1) If there are n mutually exclusive, equally likely, exhaustive events of a Random experiment, and m of them are favourable to an event E, then the probability of event E is $P(E) = \frac{m}{n}$

1.2) Sure Event: The event which is sure to happen is called a 'Sure event' or a 'certain event'.

1.3) Impossible Event: The event which is impossible to happen is called an Impossible event.

1.4) Exhaustive Events: A set of events is said to be exhaustive if the union of all these events results S.

1.5) Equally likely events: Events of a Random experiment are said to be equally likely events if all of them have equal chance of happening.

1.6) Mutually Exclusive events: Events are said to be mutually exclusive (disjoint) if, happening of any one of them prevents the happening of all other events.

2) $P(E) + P(\overline{E}) = 1 \Rightarrow P(\overline{E}) = 1 - P(E)$

3.1) Addition Theorem on probability: If A, B are any two events of a random experiment then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

3.2) If A, B are **mutually exclusive** events then $P(A \cup B) = P(A) + P(B)$.

3.3) $P(A \cup B) = 1 - P(\overline{A \cup B}) = 1 - P(\overline{A} \cap \overline{B})$

3.4) $P(A \cup B \cup C) = 1 - P(\overline{A \cup B \cup C}) = 1 - P(\overline{A} \cap \overline{B} \cap \overline{C})$

4.1) Conditional Event: Let A,B be two events of a sample space S. If B occurs only after (from) the occurrence of A, then the event of occurrence of B w.r.to A is called conditional event of B given A and it is denoted by B/A.

4.2) The **conditional probability** of B given A, is $P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{n(A \cap B)}{n(A)}$

5) Multiplication Theorem on Probability: If A and B are two events of a random experiment then $P(A \cap B) = P(A).P(B|A) = P(B).P(A|B)$, $P(A) \neq 0$, $P(B) \neq 0$

6) If A,B are two mutually exclusive and exhaustive events and E is any event that happens from either A or B then $P(E) = P(A)P(E|A) + P(B)P(E|B)$

7.1) Two events A,B in a sample space S are said to be **independent** if $P(B|A) = P(B)$

7.2) Two events A,B in a sample space S are independent iff $P(A \cap B) = P(A)P(B)$

8) Baye's Theorem: If $E_1, E_2....E_n$ are mutually exclusive and exhaustive events in a sample space S and A is any event intersecting with any E_i such that $P(A) \neq 0$ then

$$P(E_k | A) = \frac{P(E_k)P(A/E_k)}{\sum_{i=1}^{n} P(E_i).P(A/E_i)}$$