# 10.RANDOM VARIABLES & DISTRIBUTIONS

(1 x 2) + (1 x 7) = 9 Marks

## IMP FORMULAS, KEY CONCEPTS

1) **Mean:** Let X: S→R be a discrete random variable, with range $\{x_1, x_2 ...\}$ then the mean of X if exists, denoted by $\mu$ or $\overline{x}$ is given by $\mu = \Sigma x_i P(X=x_i)$ i.e., $\mu = \Sigma x_i .P(x_i)$.

2) **Variance:** The variance, if exists, is given by $\sigma^2 = \Sigma x_i^{\,2}.P(X=x_i) - \mu^2 = \Sigma (x_i - \mu)^2.P(X=x_i)$

3) **Standard Deviation(S.D):** The Standard Deviation $\sigma$ of the random variable X is the non negative value of the square root of the variance.

4) Let n be a positive integer and p be a real number such that $0 \le p \le 1$. A random variable X with range $\{0,1,2...n\}$ is said to follow binomial distribution or Bernoulli distribution with parameters n and p if $\mathbf{P(X=r) = {}^nC_r q^{n-r} p^r}$, for r=0,1,2....n, where q=1−p.

   Here, the Binomial Distribution is given by $(q+p)^n$.

5) If the random variable X follows a binomial distribution with parameters n and p then

   (i) the **mean** = **np** (ii) the **variance** = **npq**, where q=1−p.

6) A random variable X with range $\{0,1,2,....\}$ is said to follow Poisson Distribution with parameter

   $\lambda > 0$ if $\mathbf{P(X=r) = \dfrac{e^{-\lambda}\lambda^r}{r!}}$, for r=0,1,2.....

7) If a random variable X follows Poisson distribution with parameter $\lambda$, then the mean of X is $\lambda$ and the variance of X is $\lambda$.