16,000 to 24,000 kms and (iii) at least 30,000 kms.

(b) Obtain moment generating function of the Geometric distribution. Also find its mean and variance.

(c) If the probability is 0.40 that a child exposed to a certain contagious disease will catch it, what is the probability that the tenth child exposed to the disease will be the third to catch it? Also, name the distribution used. (5,5,5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2046 **F**

Unique Paper Code : 2374001201

Name of the Paper : (a) - Introductory Probability

Name of the Course : **GE : Statistics**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **five** questions from **Section B**.
4. Use of a non-programmable scientific calculator is allowed.

Section – A

1. Answer the following :

(a) If P(A) = 0.6, P(B) = 0.3 and $P(A \cap \bar{B}) = 0.4$, then find the value of $P(\bar{B}|A)$.

(b) If X follows an exponential distribution with parameter 4, then find var(X).

(c) State the conditions under which Poisson distribution is a limiting case of the Binomial distribution.

(d) If E(X) = 5, E(Y) = 6, var(X) = 15, var(Y) = 25, then find $E(3X^2 + 4Y^2)$.

(e) Let X be normally distributed with mean 12 and standard deviation 4, find $P(0 \leq X \leq 12)$.

(f) A card is drawn at random from a pack of cards. Find the probability that the card is either a spade or a king?

(g) If $\mu_X = 10$, $\mu_Y = 20$, $\sigma_X^2 = 25$, $\sigma_y^2 = 36$ and

normal variates is also a normal variate.

(b) Two independent random variables X and Y are both normally distributed with means 1 and 2 and standard deviations 3 and 4 respectively. If Z = X – Y, then

(i) Identify the distribution of Z and write its p.d.f.

(ii) State the mean, median and standard deviation of the distribution of Z.

(iii) Find $P(Z + 1 \leq 0)$. (7,8)

8. (a) Let random variable X denote the kms (in '000 kms) with a certain kind of tyre having the probability density function :

$$f(x) = \begin{cases} \frac{1}{20} e^{-x/20} & ; \text{ for } x > 0 \\ 0 & ; \text{ for } x \leq 0 \end{cases}$$

Find the probabilities that one of these tyres will last (i) at most 10,000 kms (ii) anywhere from

Y + 2Z and V = X – 3Y + Z. (8,7)

5. (a) Define Beta distribution of first kind and find the mean and variance.

(b) Let X is distributed as a binomial variate with parameters n and p, what is the distribution of Y = n – X? (8,7)

6. (a) Obtain the Moment Generating Function of the Binomial distribution. Derive from the result that the sum of two binomial variates is a binomial variate if the variates are independent and have the same probability of success.

(b) If X and Y are independent Poisson variates with parameters λ and μ respectively such that

P(X=1) = P (X=2) and P(Y=2) = P(Y=3)

Find the variance of X–2Y. (8,7)

7. (a) Prove that a linear combination of independent

cov(X, Y) = 100, then find var(2X – 3Y).

(h) Let $f(x)=\frac{x^2}{20}$, for x = 0,1,2,3,4. Determine whether f(x) can serve as the probability distribution of a random variable.

(i) If X and Y are independent random variables with variances 2 and 3 respectively, find the variance of Z = 2X + 4Y.

(j) If $M_X(t) = (0.6 + 0.4e^t)^8$ then find $P(X \leq 3)$.

(1×5,2×5)

Section – B

2. (a) Define conditional probability with example. A manufacturer of airplane parts knows from past experience that the probability is 0.80 that an order will be ready for shipment on time, and it is 0.72 that an order will be ready for shipment on time and will also be delivered on time. What is the probability that such an order will be delivered on time given that it was ready for shipment on

time?

(b) A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers of the purchase department, 2 officers of the sales department and 1 chartered accountant. Find the probability of forming the committee in the following manners :

(i) There must be one from each category.

(ii) It should have at least one from the purchase department.

(iii) The chartered accountant must be in the committee. (9,6)

3. (a) Find the mean and variance of the random variable X which has the following probability density function :

$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & otherwise \end{cases}$$

(b) Suppose that the time in minutes that a person has to wait at a certain bus stop for a bus is found to be a random phenomenon, with a probability density function given by

$$f(x) = \begin{cases} 1/8 & \text{for } 0 \le x < 2 \\ x/8 & \text{for } 2 \le x < 4 \\ 0 & \text{otherwise} \end{cases}$$

(i) Obtain the c.d.f. of X.

(ii) What is the probability that a person will have to wait more than two minutes?

(iii) Obtain mean of X. (7,8)

4. (a) Define expected value of a random variable X. Let X be a random variable with the following probability distribution

X	-3	6	9
P(X=x)	1/6	1/2	1/3

Find the E(X) and $E(X^2)$ and evaluate $E(2X+1)^2$.

(b) Three random variables X, Y and Z have means $\mu_X = 2$, $\mu_Y = -3$, $\mu_Z = 4$, variances $\sigma_X^2 = 1$, $\sigma_Y^2 = 5$, $\sigma_Z^2 = 2$ and $cov(X, Y) = -2$, $cov(Y, Z) = -1$, and $cov(Z, X) = 1$. Find cov(U, V), where $U = 3X -$