N.B. (i) All questions are compulsory.
   (ii) Attempt ANY TWO-sub questions out of Q1, Q2 and Q3.
   (iii) Attempt ANY THREE-sub questions from Q4.
   (iv) Figures to the right indicate marks.

Q.1. (a) Show that for any two events A and B,   10
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
Also derive the result when A and B are mutually exclusive events.

(b) A committee of 3 is to be formed from among 5 boys and 3 girls. What is   10
the probability that the committee shall have –
i) 2 boys and 1 girl
ii) at least one boy
iii) more girls than number of boys.

(c) Two cards are drawn from a normal pack of 52 well-shuffled cards. Find the   10
probability that the cards drawn are –
i) both black
ii) one black and one heart
iii) both aces
iv) one ace and one king
v) both face cards

(d) In a bolt factory, three machines A, B and C produce 25, 35 and 40 percent   10
of total output respectively and it is found that 5, 4 and 2 percent
respectively are defective bolts in their production. If a bolt is chosen at
random from the total output, what is the probability that it is defective?
If a bolt is chosen and is found to be defective , what is the probability that
the bolt came from machine A ?

Q.2. (a) Define Expectation E(X) and Variance V(X) of a discrete random variable   10
X. Show that-
i) $E(aX + b) = a\,E(X) + b$
ii) $V(aX + b) = a^2\,V(X)$, where a and b are constants.

(b) Find K in the following case so that p(x) can be regarded as a probability   10
distribution function.

X :	-1	0	1	2
P(X) :	$\frac{k+1}{13}$	$\frac{1}{13}$	$\frac{k}{13}$	$\frac{k-4}{13}$

Also find Expected value of X.

(c) Following is joint probability mass function of X and Y.   10

x\y	1	2	3
5	---	0.05	0,10
10	0.15	0.20	0.20
15	0,10	0,05	0.05
20	---	---	0.10

Obtain- i) Marginal probability distributions of X and Y
ii) Conditional probability distribution of Y when X ≥ 3.
iii) Conditional probability distribution of X when Y≤ 2

(d) Explain joint probability distribution of two discrete random variables.   10
Define (i) joint probability mass function
      (ii) marginal probability mass function
      (iii) conditional probability mass function.

Q.3. (a) Define a random variable X that follows discrete uniform distribution with   10
parameter n. Also find its mean and variance.

(b) The sales manager of an automobile dealer estimates that 90% of the new   10
cars delivered by them have no defect and so will not be brought back
immediately for repair. He sells a fleet of 6 cars to an important customer.
What is the probability that –
(i) no car will be brought back
(ii) all cars will be brought back
(iii) one or more cars will be brought back for repair?

(c) A variate X follows Poisson distribution with parameter 5. Evaluate   10
(i) $p(x=0)$ (ii) $p(x=1)$ (iii) $p(x \geq 1)$ (iv) $p(x \neq 0)$.
Given that $e^{-5} = 0.00674$.

(d) A digit is drawn at random from among the digits 1, 2, 3, 4, 5, 6, 7, 8, 9 and   10
0. If X denotes the digit drawn, find $p(x)$, $E(X)$ and $V(X)$.

Q.4. (a) Tickets numbered from 1 to 100 are well shuffled and a ticket is drawn   5
from it. What is the probability that the selected ticket has:
(i) an odd number
(ii) number 5 or multiple of 5 ?

(b) A discrete random variable X takes values -2, 0 and 2 with probabilities 0.2,   5
0.5 and 0.3 respectively. Find the probability distribution function of -
(i) $Y = 2X + 1$ (ii) $Z = X^2 + 1$

(c) A Binomial distribution has mean 6 and variance 3. Find n and p.   5

(d) On an average three divorce cases are filed in a court of a small city. Find   5
the chance that on a certain day the number of such cases coming up would
be (i) one
      (ii) at least two
      (iii) at most two
Given: $e^{-3} = 0.04979$

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