Time: 3 hours   **Max. Marks: 80**

N.B. : 1) Question no. 1 is compulsory
      2) Answer any 3 questions from remaining five questions

Q1   Answer any four questions

    a.   Explain Bayes theorem and total probability theorem.   05
    b.   Define joint distribution function. What are its properties?   05
    c.   Find the Binomial distribution if the mean is 4 and variance is 3.   05
    d.   Find the characteristic function of a random variable X with uniform distribution   05
       in [-1, 1]   05
    e.   List the properties of autocorrelation function and prove any two properties.

Q2 a. The joint pdf of R.V. X & Y is given as   10
        $f_{XY}(x,y) = c\ e^{-x}\ e^{-y}$,$0 < y < x < \infty$
            = 0 , elsewhere
     Find
        i.   c
        ii.   f(x) & f(y)
        iii.   f(x/y) & f(y/x)

    b. A biased coin tossed till a head appears for the first time. What is the probability that the   06
       numbered required tosses are odd?

    c. Show that   p(AUB)=P(A)+P(B)-P(A ∩B)   04

Q3 a. If X, Y are two independent exponential random variables with common parameter λ. find   10
       the pdf of (U, V) where U = X+Y and V = X-Y. Also find f (u) and f (v).
    b. Find mean and variance of Gaussian distribution function with parameters N (0, 1).   10

Q4 a. Explain the central limit theorem   05
    b. Define SSS process and WSS process   05
    c. Random Process is given as X (t) = sin (wt+Y) Where Y is uniformly distributed over $(0,2\pi)$ 10
       and w is a constant. Verify that X (t) is WSS or not.

Q5 a. The joint probability distribution of X and Y is given by   10

        $P(X=x, Y=y) = \dfrac{x+3y}{24}$ where x=1, 2 and y=1, 2. Find

        i.   Marginal distributions of x and y
        ii. $P(X \le 2, Y \le 1)$
        iii. $P(X \le 1)$
    b.
       Two dimensional random variables (X, Y) has the following distribution   10
           $f_{XY}(x,y) = 2-x-y$, $0 \le x \le 1, 0 \le y \le 1$
             = 0 , elsewhere
     Find
        i.   E(XY)
        ii.   Cov (X, Y)

Q6 a. Prove that for a linear time invariant system, if the input is a WSS process, then output is   10
       also WSS Process.
    b. From the following data, obtain the two regression equations.   10

Sales	91	97	108	121	67	124	51	73	111	57
Purchases	71	75	69	97	70	91	39	61	80	47

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