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.   What are the three axioms of probability?   **05**
        b.   Define central limit theorem. What is the significance of central limit theorem?   **05**
        c.   A continuous random variable x that can assume any value between x = 2 and x   **05**
             = 5 has a density function given by f(x) = k (1+x). Find P(X<4)
        d.   Define SSS process. How it is different from WSS?   **05**
        e.   Define autocorrelation function and state its properties   **05**

Q2   a.   In a binary Symmetric channel, the probability that a transmitted '0' is received   **10**
             as '0'is 0.9 and the probability that a transmitted '1' is received as '1'is 0.95. If
             the probability that a '0' is transmitted is 0.55, find
             i) The probability that a '1'was transmitted given that a '1' was received.
             ii) The probability that a '0'was transmitted given that a '0' was received.
             iii) Error probability
        b.   i.   Three balls are drawn at random without replacement from a box   **05**
                  containing 2 white, 3 red and 4 black balls. If X denotes the number of
                  white balls drawn and Y denotes the number of red balls drawn, find the
                  joint probability distribution of (X,Y)
             ii. State and Prove Bayes Theorem   **05**

Q3   a.   The joint pdf of two dimensional RV (X,Y) is given by   **10**

$$f(x, y) = x^2 + \frac{xy}{3}; \ 0 \le x \le 1, \ 0 \le y \le 2 \quad . \text{ Find}$$

             i.   P(Y<0.5/X<0.5)
             ii.   Are x and y independent random variables?
        b.   State and prove Chebyshev inequality.   **10**

Q4   a.   Derive the moment generating function for Poisson distribution. By using the   **10**
             moment generating function, derive the mean and variance of Poisson
             distribution   **10**
        b.   If the joint pdf of (X,Y) is given by f (x,y)=x+y ; $0 \le x,y \le 1$, find the pdf of
             U=XY

Q5   a.   If the joint pdf of (X,Y) is given by f (x,y)=24y(1-x), $0 \le y \le x \le 1$, Find E(XY)   **10**
        b.   Given a random process x (t) = A Cos (ωt+Θ) where A and ω are constants and   **10**
             Θ is a random variable with uniform distribution over (-π, π), Verify whether x
             (t) is a WSS process or not.

Q6   a.   Discuss the properties of linear time invariant system if input is a WSS process.   **10**
        b.   Find linear regression equation for the following two sets of data. Predict the   **10**
             output when input x=7. State any two applications of linear regression.

x	2	4	6	8
y	3	7	5	10

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