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 = 5 has a density function given by f(x) = k (1+x). Find P(X<4)	**05**
	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 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	**10**
	b.	i. Three balls are drawn at random without replacement from a box 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)	**05**
		ii. State and Prove Bayes Theorem	**05**
Q3	a.	The joint pdf of two dimensional RV (X,Y) is given by $f(x,y) = x^2 + \frac{xy}{3};\ 0 \le x \le 1,\ 0 \le y \le 2$. Find i. P(Y<0.5/X<0.5) ii. Are x and y independent random variables?	**10**
	b.	State and prove Chebyshev inequality.	**10**
Q4	a.	Derive the moment generating function for Poisson distribution. By using the 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	**10**
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 ϴ is a random variable with uniform distribution over (-π, π), Verify whether x (t) is a WSS process or not.	**10**
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 output when input x=7. State any two applications of linear regression.	**10**

x	2	4	6	8
y	3	7	5	10

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