University of Mumbai

Program: **Electronics & Telecommunication**

Curriculum Scheme: Rev2019

Examination: TE Semester V

Course Code: ECC504 and Course Name: Random Signal Analysis

Time: 2 hour 30 minutes Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	If a random variable X has mean 3 and s.d. 5, then the variance of variable Y=2X-5 is
Option A:	100
Option B:	25
Option C:	45
Option D:	30
2.	Two random variables are said to be independent if
Option A:	E(XY)=E(X)E(Y)
Option B:	E(XY)=0
Option C:	E(XY)=1
Option D:	E(XY)=5
3.	If correlation coefficient is -1, then the relation between X and Y is of the type:
Option A:	Y increases, X increases
Option B:	Y increases, X decreases
Option C:	Y decreases, X decreases
Option D:	X and Y are not related
4.	If X is a random variable with mean m, the $E[(X-m)^r]$ is called
Option A:	rth raw moment
Option B:	standard deviation
Option C:	rth central moment
Option D:	Variance
5.	The joint probability mass function of X and Y be f(x,y)=(x+y)/21, x=1,2,3; y=1,2; the P(X=3) is equal to:
Option A:	4/9
Option B:	3/7
Option C:	1/9
Option D:	4/7
6.	Find mean and variance for a random variable X following Poisson distribution with n=1000 and p=0.005.
Option A:	5, 2.5
Option B:	2,5
Option C:	7.5, 5
Option D:	5, 5

7.	A bag contains 5 white, 7 red and 3 black balls. If 3 balls are drawn at random, what is the probability that none of them is red?
Option A:	4/65
Option B:	8/65
Option C:	12/65
Option D:	17/65
8.	Find mean & variance for the discrete random variable X taking values 1,3,4,5 with probabilities 0.4, 0.1, 0.2 and 0.3.
Option A:	3,3
Option B:	2,3
Option C:	3,4
Option D:	2.5,2
9.	What is the probability of occurrence of 53 Sundays in a leap year?
Option A:	2/7
Option B:	1/7
Option C:	3/7
Option D:	4/7
10.	Find mean and variance for a random variable X following Binomial distribution with n=10 and p=0.5.
Option A:	1.5, 5
Option B:	7.5, 3
Option C:	5, 2.5
Option D:	7.5, 5

Q2 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Short note on Central Limit Theorem
ii.	State and explain Baye's Theorem
iii.	Find the characteristic function of Poisson Distribution and hence find its mean and variance
B	**Solve any One** **10 marks each**
i.	The joint pdf of two random variables is given by $f(x,y)=15e^{-3x-5y}$ x>0, y>0 (a)Find marginal pdfs of X and Y (b)Find the probability that x<2 and y>0.2
ii.	Explain Ergodicity in Random Process. A Random process is given by X(t)=10 cos(50t + Y) where Y is a Random variable that is Uniformly distributed in the interval (0, 2π). Show that X(t) is a WSS process and it is Correlation ergodic.

Q3 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Short note on markov chain
ii.	Explain simple and multiple linear regression.

iii.	A Random process is given by $X(t)=A\cos(\omega t + Y)$ where ω is constant and Y is a Random variable that is Uniformly distributed in the interval $(-\pi, \pi)$. Show that X(t) is a WSS process.
B	**Solve any One** **10 marks each**
i.	If X and Y are independent Random variables and if Z=X+Y , then show that the pdf of Z is given by the convolution of the pdf of X and pdf of Y.
ii.	State and explain properties of PDF and CDF.

Q4 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Short note on Poisson Distribution
ii.	A continuous random variable has the probability density function. $f(x)= k(x-x^2) \quad 0<x<1$ Find k, mean and variance.
iii.	Explain with an example use of simple regression in prediction of new observations.
B	**Solve any One** **10 marks each**
i.	A distribution has unknown mean μ and variance 1.5. Using Central Limit Theorem find the size of the sample such that the probability that difference between sample mean and the population mean will be less than 0.5 is 0.95
ii.	Explain Markov and Chebyshev inequality.