

University of Mumbai

Program: **Electronics and Telecommunication Engineering**

Curriculum Scheme: **Rev2019**

Examination: **Third Year Semester V**

Course Code: **ECC504** and Course Name: **Random Signal Analysis**

Time: 3 hours

Max. Marks: 80

Q1. (20 Marks)	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks. 2 marks each
1.	Which of the following is not equally likely event?
Option A:	Tossing a dice
Option B:	Tossing a coin
Option C:	Picking a ball containing many balls of different colors
Option D:	All of the above
2.	If $F(x)$ is a Cumulative distribution function of a random variable X , then $F(x)=?$
Option A:	1
Option B:	$df(x)/dx$
Option C:	$\int_{-\infty}^x f(x)dx$
Option D:	$\int_{-\infty}^{\infty} f(x)dx$
3.	If X is a Poisson random variable with $P(X=1)=P(X=2)$, find mean and Variance.
Option A:	1 and 2
Option B:	2 and 2
Option C:	3 and 3
Option D:	0 and 1
4.	A random variable X has a uniform distribution over $(-3,3)$ Compute $P(X<2)?$
Option A:	5/6
Option B:	1/6
Option C:	2/3
Option D:	1/2
5.	Which of the following theorem states that the probability distribution function of the sum of a large number variables of random with arbitrary distribution approaches a Gaussian Distribution?
Option A:	Central Limit Theorem
Option B:	Probability Theorem
Option C:	Central Moment theorem
Option D:	Chebyshev inequality
6.	If the correlation between two random variables X and Y is zero then they are said to be
Option A:	Orthogonal
Option B:	Independent
Option C:	Correlated
Option D:	Uncorrelated

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7.	A random process becomes a random variable when _____ is fixed at some particular value.
Option A:	Time
Option B:	Frequency
Option C:	sample,
Option D:	Amplitude
8.	Which of the following is incorrect statement about the mean value of a Random process?
Option A:	It is an ensemble average of the random process $X(t)$.
Option B:	It is time average of the random process $X(t)$.
Option C:	It is a function of time and is denoted by $\mu_X(t) = E[X(t)]$, where $E[X(t)]$ is the expected value of $X(t)$.
Option D:	It depends upon probability density function of a random process $f_X(x, t)$.
9.	With reference to the mean square value of a random process $X(t)$ which of the following is true?
Option A:	It is also known as total power of random process $X(t)$.
Option B:	It is also known as average power of random variable X .
Option C:	It is calculated by Autocorrelation function at time $t=0$.
Option D:	This parameter is not defined for random process.
10.	Two lines of regression coincide if and only if
Option A:	$\rho_{xy} = 0$
Option B:	$\rho_{xy} = \pm \frac{1}{\sqrt{2}}$
Option C:	$\rho_{xy} = \pm 1$
Option D:	$\rho_{xy} = \pm \frac{1}{2}$

Q2. (20 Marks)	Solve any Two Questions out of Three	10 marks each
A	A company producing electric relays has three manufacturing plants producing 50, 30, and 20 percent, respectively, of its product. Suppose that the probabilities that a relay manufactured by these plants is defective are 0.02, 0.05, and 0.01, respectively. (a) If a relay is selected at random from the output of the company, what is the probability that it is defective? (b) If a relay selected at random is found to be defective, what is the probability that it was manufactured by plant 2?	
B	If the probability mass function of a random variable X is given by, $P(X=r)=kr^3$; $r=1,2,3,4$. Find i) the value of k, ii) $P(1/2 < X < 5/2) / (X > 1)$, iii) the mean and variance of X, iv) the distribution function of X.	
C	Suppose X and Y are two random variables. Define Covariance and correlation of X and Y. When do you say that X and Y are i) Orthogonal ii) Independent	

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	iii) Uncorrelated Are uncorrelated variables independent?
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Q3. (20 Marks)	Solve any Two Questions out of Three. 10 marks each
A	Define discrete and continuous random variables by giving examples. Discuss the properties of distribution function.
B	Write a short note on the following special distributions: 1) Poisson Distribution 2) Gaussian Distribution
C	A Random process is given by $X(t) = 10 \cos(50t + Y)$ where ω is constant and Y is a Random variable that is uniformly distributed in the interval $(0, 2\pi)$. Show that $X(t)$ is a WSS process and it is Correlation ergodic.

Q4. (20 Marks)	Solve any Two Questions out of Three.	10 marks each				
A	The random variables X and Y have joint pdf given by $f_{X,Y}(x,y) = 4xy : 0 < x < 1, 0 < y < 1$ $= 0 \quad ; \text{otherwise.}$ Find the joint pdf of $V = X^2$ and $W = XY$.					
B	Explain Power spectral density function. State its important properties and prove any two of the properties. Explain Power spectral density function. State its important properties and prove any two of the properties.					
C	The following table gives the data on rainfall and discharge in a certain river. Obtain the line of regression of y and x.					
	Rainfall (inches) X	1.53	1.78	2.60	2.95	3.42
	Discharge 100 c.c. Y	33.5	36.3	40.0	45.8	53.5