Sub Code: R2321041 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURAJADA VIZINAGARAM

II B. Tech I Semester Regular/Supply Examinations, November – 2025

RANDOM VARIABLES AND STOCHASTIC PROCESS

(ECE)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part A, Part B.
Part A is compulsory, Answer all questions.
In Part B, Answer any one question from each unit.

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PART-A (20 Marks)

1 a) Classify Random variable. [2]
b) What is the application of Binomial Random Variable? [2]
c) Define Skew? [2]
d) What is Transformation Random Variable? [2]
e) Define Joint Characteristic function? [2]
f) What is E[3X+5]? Where mean value is 3. [2]
g) Define Random Processes? [2]
h) Define Ergodicity. [2]
i) List out properties of PSD? [2]
j) What is the System Response of Auto correlation function for Linear Systems? [2]

PART-B (50 Marks)

Unit-1

2 a) Define probability distribution function and write the properties [5]
b) A rifleman can achieve a "Marksman" award if he passes a test. He is allowed to fire six shots at a target's bull's eye. If he hits the bull's eye with at least five of his six shots he wins a set. He becomes a marksman only if he can repeat the feat three times straight, that is; if he can win three straight sets. If his probability is 0.8 of hitting a bull's eye on any one shot, find the probability of becoming a Marksman [5]

(OR)

3 a) Define Random variable? List out the properties of Distribution Function [5]
b) Explain below random variables [5]
i)Gaussian ii) uniform

Unit-2

4 a) Find the expected value of the function $g(X) = X^3$ where X is a random variable defined by the density [5]

$$f_X(x) = \left(\frac{1}{2}\right) u(x) \exp(-x/2).$$

b) State and prove chebchev's inequality? [5]

(OR)

5 a) Let X be a random variable with exponential density function [5]

$$f_x(x) = \begin{cases} y_b \; e^{-(x-a)/b} & x > a \\ 0 & x < a \end{cases}$$

Find out its mean and variance

	b)	Show that the second moment of any random variable 'X' about arbitrary point 'a' is minimum when $a = \overline{X}$	[5]

Unit-3

6		Find the density function of W=X+Y, where the densities of X and Y are assumed to be: $f_X(x)=0.5[u(x)-u(x-2)]$; $f_Y(y)=0.5[u(y)-u(y-2)]$	[10]

(OR)

7	a)	Two random variables having joint characteristic function $\emptyset_{XY}(\omega_1, \omega_2)= \exp(-2\omega^2_1-8\omega^2_2)$. Find moment's m_{10}, mo_1, m_{11}?	[5]
	b)	Gaussian random variables X and Y have first and second order moments m_{10}=-1.1, m_{20}=1.16, m_{01}=1.5,m_{02} =2.89,R_{XY}=-1.724 find C_{XY}, ρ?	[5]

Unit-4

8	a)	List all the properties of autocorrelation function.	[5]
	b)	Given a random process X(t) = kt, where A is a random variable uniformly distributed in the range (-1, 1). Is the process WSS?	[5]

(OR)

9	a)	Give an example of a random process that satisfies the following: (i) Mean ergodicity (ii) Auto-correlation ergodicity	[5]
	b)	Explain about Poisson random processes.	[5]

Unit-5

10	a)	Explain properties of Cross-Power Spectrum density	[5]
	b)	Find the PSD and average Power of X(t) with $R_{XX}(\tau) = \exp\,(-\vert\tau)\vert$	[5]

(OR)

11	a)	Derive the relation between PSD of output and PSD of input of an LTI system.	[5]
	b)	If X(t) is a stationary process, find the power spectrum of Y(t)=A0+B0 X(t) in terms of the power spectrum of X(t) if A0 and B0 are real constants.	[5]