2025-12-17

PROBABILITY AND RANDOM PROCESSES

Department of Electronics and Communication Engineering

SRM UNIVERSITY A.P

Registration Number: _____

Name: _____

Branch & Section: _____

SRM UNIVERSITY AP
Andhra Pradesh

SRM UNIVERSITY – AP, ANDHRA PRADESH

End Term Examination, Dec 2025

[Question Paper ID: **010696]**

Subject Title	:	PROBABILITY AND RANDOM PROCESSES	**Subject Code**	:	ECE 203
Batch	:	2024	**Max Marks**	:	100
Degree	:	B.Tech.	**Duration**	:	3 hours
Branch	:	ECE	**QP Set**	:	1

Section-A: Answer all questions. Each question carries 3 marks (10 × 3 = 30 Marks)

Answer **all** Questions

		Marks	CO	BL
1.	List the important axioms of probability of an event.	**3**	**1**	**1**
2.	State Total probability theorem. Briefly explain with suitable Venn diagram.	**3**	**1**	**1**
3.	Define Probability Distribution Function. Write any two of its properties	**3**	**2**	**1**
4.	What is continuous random variable. Give an example and write down its PDF.	**3**	**2**	**2**
5.	Express Variance of a random variable in terms of its mean and mean square value.	**3**	**2**	**2**
6.	If ' V' is the variance of a random variable 'x'. Then compute the variance of the random variable represented by **aX+b,** where **a** and **b** are real numbers.	**3**	**2**	**1**
7.	State Chebychev's ineuality.	**3**	**3**	**3**
8.	Write any three important properties of joint density function of two random variables.	**3**	**3**	**2**
9.	Define Auto correlation of a random process X(t) and write any two properties.	**3**	**3**	**2**
10.	Define an Ergodic Process.	**3**	**3**	**2**

Section-B: Answer any 5 questions. Each one carries 6 marks. (5 × 6 = 30 Marks)

Answer **any 5** Questions

		Marks	CO	BL
11.	State and prove Bayes' Theorem.	**6**	**1**	**2**
12.	Define Probability density function. Prove any two of its properties.	**6**	**2**	**2**
13.	Determine the real constant 'a', such that the following function is a valid density function. Please assume that m and b are arbitrary constants, where b>0 $f(x) = ae^{\frac{-\lvert x-m\rvert}{b}}$	**6**	**2**	**2**
14.	A discrete random variable x has possible values $x_i = i^2$, where i = 1,2,3,4,5 which occur with probabilities 0.4, 0.25, 0.15, 0.1 and 0.1 respectively. Find the mean of the random variable.	**6**	**3**	**3**

		Marks	CO	BL
15.	State and prove any two properties of joint distribution function of two random variables X and Y.	6	3	2
16.	Define auto-correlation function of two random variables X and Y, list its properties.	6	4	2
17.	An ergodic process X(t) has the following auto-correlation function.	6	4	3

$$R(\tau) = 18 + \frac{2}{6+\tau^2}[1 + 4\cos(12\tau)]$$

a) Find the mean of the random variable x
b) Find its average power.

Section-C. Answer any 4. Each question carries 10marks (4 × 10 = 40 Marks)

Answer **any 4** Questions

		Marks	CO	BL
18.	For a Gaussian random variable X, show that	10	3	3

$$\int_{-\infty}^{\infty} xf(x)dx = \mu$$

Where f(x) is density function and μ represents the mean of X.

19.	Prove any four properties of CDF of a random variable X.	10	2	2
20.	For a bivariate probability density function given below,	10	2	2

X \ Y	1	2	3	4	5	6
0	0	0	1/32	2/32	2/32	3/32
1	1/16	1/16	1/8	1/8	1/8	1/8
2	1/32	1/32	1/64	1/64	0	2/64

Find

a) $P(X \leq 1)$

b) $P(Y \leq 3)$

21.	State and prove Central limit theorem for identical distributions.	10	3	3
22.	Given a random process X(t),	10	4	3

$$X(t) = Asin(\omega_0 t + \varphi)$$

Where A and ω_0 are constants, φ is uniform random variable distributed in the interval [-π, π].

A new random variable is defined as $Y(t) = X^2(t)$.

Verify whether X(t) and Y(t) are WSS processes?

23.	State and prove Wienner-Kinchin relation between auto-correlation and power spectral density of a random process.	**10**	**5**	**3**

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