Hall Ticket Number:

Code No. : 14422

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (E.C.E. : CBCS) IV-Semester Main Examinations, January-2021

Probability Theory and Stochastic Process

Time: **2** hours Max. Marks: **60**

*Note: Answer any **NINE** questions from **Part-A** and any **THREE** from **Part-B***

Part-A (9 × 2 = 18 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Define probability as a relative frequency.	2	1	1	1
2.	What are the classifications of random variables?	2	2	1	1
3.	Define Gaussian distribution function and list its properties.	2	1	3	1
4.	What is the Skewness of a random variable?	2	1	3	1
5.	State Central Limit Theorem.	2	1	3	1
6.	Write important properties of Gaussian random variables.	2	2	3	1
7.	How do you explain mean Ergodic random process and cross correlation Ergodic random process?	2	4	2	1
8.	A random process X(t) is defined as $X(t) = A; 0 \le t \le 1$ Where A is random variable that is uniformly distributed from -θ to θ. Prove that auto correlation function of X(t) is $\theta^2/3$.	2	3	2	2
9.	What is the relation between cross correlation function and cross power density spectrum?	2	1	5	1
10.	The bandwidth of a system is 10 MHz. Find the thermal noise voltage across an 800Ω resistor at room temperature 27^0C.	2	3	4	2
11.	One card is drawn from a regular deck of 52 cards. What is the probability of the card being either red or a king?	2	3	1	2
12.	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).	2	4	3	2
	Part-B (3 × 14 = 42 Marks)				
13. a)	(i) Explain briefly Total Probability and Bayes' Theorem. (ii) Illustrate mutually exclusive events and independent events with an example.	7	1	1	1
b)	A company producing electric relays has three manufacturing plants producing 50%,30% and 20% respectively of its product. Suppose the probabilities that a relay manufactured by these plants is defective are 0.02, 0.05 and 0.01 respectively. i) If a relay is selected at random from the output of the company, what is the probability that it is defective? ii) If a relay selected at random is found to be defective, what is the probability that it was manufactured by plant 2?	7	1	1	3

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14. a)	Explain "Binomial distribution function" and derive the mean, variance & standard deviation.	7	4	1	1
b)	A random variable has a characteristic function given by $\phi_X(w) = \begin{cases} 1 - \lvert w \rvert, \lvert w \rvert \le 1 \\ 0, \lvert w \rvert \ge 1 \end{cases}$. Find mean and variance of X	7	3	3	3
15. a)	Distinguish between Joint Probability Distribution and Probability Density functions and their properties.	10	2	2	2
b)	Joint density of two random variables X and Y is $f_{x,y}(x,y) = \frac{(x+y)^2}{40}; -1 < x < 1, -3 < y < 3$ Find the mean values of X and Y.	4	3	2	3
16. a)	Distinguish auto correlation and cross correlation with respect to their definitions and properties.	8	1	5	2
b)	Two random processes X(t) and Y(t) be defined by $X(t) = A\cos\omega t + B\sin\omega t$ and $Y(t) = B\cos\omega t - A\sin\omega t$, where A & B are two random variables and ω is a constant. Find the cross-correlation function and show that X(t) and Y(t) are jointly WSS.	6	3	5	3
17. a)	Explain the following terms with respective applications of communication systems. i) Effective Noise temperature ii) Noise Factor iii) Thermal Noise. iv) White Noise	8	2	4	1
b)	Find the cross-correlation function for the power spectral density is $S_{XY}(\omega) = \frac{1}{25+\omega^2}$.	6	3	5	3
18. a)	Explain Characteristic function and their properties.	8	2	3	1
b)	A fair coin is tossed 4 times. Write the sample space and find the probability of the event that (i) Number of heads is more than the number of Tails (ii) Tails occur in the second and Fourth tosses of the coin.	6	1	1	3

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19.	Answer any ***two*** of the following:				
a)	Auto correlation function of a random process X (t) is given as $R_{XX}(\tau)=25+\frac{4}{1+6\tau}$ Find mean, and variance of random process.	7	3	5	3
b)	The Joint probabilities of two random variables X & Y are given in table.	7	3	2	3

Y\X	1	2	3
1	0.2	0.1	0.2
2	0.15	0.2	0.15

Find out 1). Joint & Marginal Distribution function.

2). Joint & Marginal Density function.

c)	For a random process, show that "Time average of its Auto Correlation function and its Power Spectral Density form a Fourier transform pair.	7	2	4	2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	60%
2	Knowledge on application and analysis (Level-3 & 4)	40%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	0%

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