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Code No. : 14463 N/O

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD**

Accredited by NAAC with A++ Grade

**B.E.-(E.C.E.) IV-Semester Main & Backlog Examinations, July-2023**

**Probability Theory and Stochastic Process**

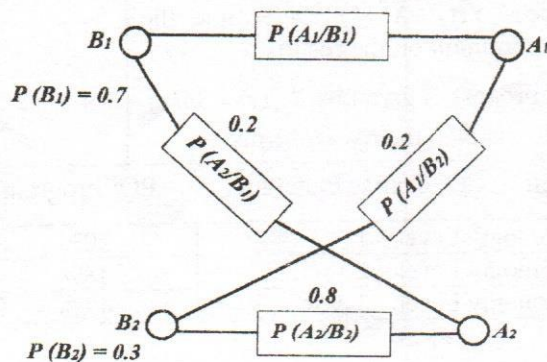
Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

**Part-A (10 × 2 = 20 Marks)**

Q. No.	Stem of the question	M	L	CO	PO	PSO
1.	Define the Probability? What are the axioms of probability?	2	1	1	1	2
2.	The probability of person A live upto 60 years is 0.25 and the probability of B lives upto 60 years is 0.35. What is the probability that both A and B lives upto 60 years.	2	1	1	2	2
3.	Define probability density function and state its properties.	2	1	2	1	2
4.	Compare moments about the origin and central moments	2	1	2	1,2	2
5.	Write a short note on point conditioning.	2	1	3	1	2
6.	The random variables X and Y have the joint characteristic function $\phi_{X,Y}(w_1, w_2) = \frac{1}{(1-j2w_1)(1-j2w_2)}$ . Find the means of X and Y	2	2	3	2	2
7.	Distinguish between ensemble averages and the time averages of random process?	2	2	4	1	2
8.	An ergodic random process X(t) has an autocorrelation $R_{XX}(\tau) = 18 + \frac{2}{6+\tau^2} [1 + 4 \cos(12\tau)]$ . Find the dc power and average power of the random process X(t)	2	2	4	2,4	2
9.	Give the relation between probability and information of a particular experiment. Also list the properties of information.	2	1	5	1	2
10.	Define white noise? Also, sketch the PSD and autocorrelation of white noise.	2	3	5	2,12	2
<b>Part-B (5 × 8 = 40 Marks)</b>						
11. a)	If a fair coin is tossed 9 times, find the probability of getting (i) Exactly 6 heads (ii) At least 6 heads (iii) At most 6 heads	4	2	1	2	2
b)	A binary symmetric channel is shown below. Find the probability of (i) A <sub>1</sub> (ii) A <sub>2</sub> (iii) P(B <sub>1</sub> /A <sub>1</sub> ) (iv) P(B <sub>2</sub> /A <sub>2</sub> ) (v) P(B <sub>1</sub> /A <sub>2</sub> ) (vi) P(B <sub>2</sub> /A <sub>1</sub> )	4	2	1	1,2	2





12.	A fair coin is tossed four times. Let X denotes the number of heads occurring. Determine and sketch the CDF of random variable X.	8	3	2	2	2
13.	The joint probability density function of $f_{X,Y}(x,y)$ is given by $f(x,y) = 8xy; \quad 0 \leq x \leq 1, 0 \leq y \leq x$ $0; \quad \text{otherwise}$ (i) Find the marginal density of X and Y. (ii) Find the conditional density functions of X and Y. (iii) Verify that whether X and Y are independent.	8	4	3	1,2	2
14. a)	Determine whether the random process $x(t) = A \cos(\omega_0 t + \theta)$ is wide stationary or not where A, $\omega_0$ are constants and $\theta$ is a uniformly distributed random variable on the interval $(0, 2\pi)$ .	4	3	4	2	2
b)	Define cross correlation function of two random processes X(t) and Y(t). Also write the properties of cross correlation function.	4	1	4	1,2	2
15. a)	Two independent stationary random process X(t) and Y(t) have power spectrum densities $S_{XX}(w) = \frac{16}{w^2+16}$ and $S_{YY}(w) = \frac{w^2}{w^2+16}$ , respectively. Also, X(t) and Y(t) are uncorrelated with zero mean value. Let another random process be $Z(t) = X(t) + Y(t)$ . Find (i) Power spectral density of Z(t) (ii) Cross power density spectrum of X(t) and Y(t) (iii) Cross power density spectrum of X(t) and Z(t)	5	2	5	2,12	2
b)	Define entropy. Also find the entropy of the memoryless source emits with probabilities 0.3, 0.2, 0.2, 0.15, 0.1, and 0.05.	3	2	5	2	2
16. a)	In a game of dice, a shooter can win outright if the sum of the two numbers showing up is either 7 or 11 when two dice are thrown. Determine the probability of winning outright?	4	3	1	2	2
b)	A continuous random variable X defined by probability density function given by $f_X(x) = 5(1-x^4)/4 \quad 0 \leq x \leq 1$ . Determine $E[X]$ , $E[X^2]$ and variance.	4	3	2	2	2
17.	Answer any <b>two</b> of the following:					
a)	Two random variables X and Y have mean values 1, 2 respectively and variances 4 and 1 respectively. Their correlation coefficient is 0.4. New random variables W and V are defined by $V = -X + 2Y$ ; $W = X + 3Y$ . Find the correlation coefficient between V and W.	4	2	3	2	2
b)	Given the random process $X(t) = A \sin(\omega_0 t + \theta)$ , where A and $\omega_0$ are constants and $\theta$ is a uniformly distributed random variable on the interval $(-\pi, \pi)$ . Define a new random process $Y(t) = X^2(t)$ . Determine the autocorrelation function of Y(t). Also comment on the result.	4	4	4	4,12	2
c)	Autocorrelation function of a random process is given by $R_{xx}(\tau) = 3\delta(\tau)$ . Find the power density spectrum. Also, sketch their waveforms.	4	2	5	2,4	2

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

i)	Blooms Taxonomy Level - 1	20%
ii)	Blooms Taxonomy Level - 2	38%
iii)	Blooms Taxonomy Level - 3 & 4	42%

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