

Name of the Student:

Register No.:



SRM Institute of Science and Technology
College of Engineering and Technology
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu
Academic Year: 2023-2024 (EVEN)

C1-Slot
SET-A

Date: 24/04/2024

Duration: 1 hr 40 Minutes.

Max. Marks: 50

Test: FT-IV

Course Code & Title: 21MAB203T-Probability and Stochastic Processes

Year / Sem: II/IV

At the end of this course, learners will be able to:		Program Outcomes (PO)											
Course Outcomes (CO)	Learning Bloom's Level	1	2	3	4	5	6	7	8	9	10	11	12
CO1 Evaluate the characteristics of discrete and continuous random variables	4	3	3										
CO2 Explain the model and analyze systems using two-dimensional random variables	4	3	3										
CO3 Classify limit theorems and evaluate upper bounds using various inequalities	4	3	3										
CO4 Analyze the characteristics of random processes	4	3	3										
CO5 Examine problems in spectral density functions and linear time-invariant systems	4	3	3										

Part-A (1 x 4 = 4 Marks)

Answer ALL the Questions

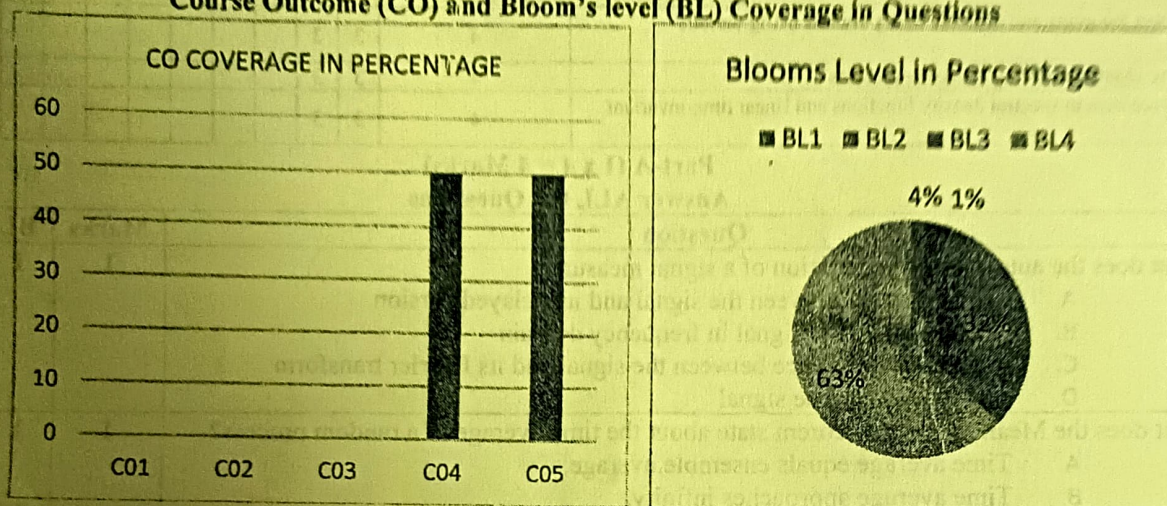
Q.No	Question	Marks	BL	CO	PO
1.	What does the autocorrelation function of a signal measure? A. The similarity between the signal and its delayed version B. The energy of the signal in frequency domain C. The phase difference between the signal and its Fourier transform D. The linearity of the signal	1	1	4	1,2
2.	What does the Mean Ergodic Theorem state about the time average of a random process? A. Time average equals ensemble average. B. Time average approaches infinity. C. Ensemble average equals zero. D. Ensemble average approaches infinity.	1	1	4	1,2
3.	The mean square value of a WSS process is equal to the total area under the graph of A. Auto correlation B. Cross Correlation C. Spectral density D. Cross Power spectral Density	1	1	5	1,2
4.	Which of the following is not a valid power spectral density function	1	2	5	1,2
	A. $\frac{1}{(1+\omega^2)^2}$ B. $\frac{4}{\omega^2+4}$				
	C. $\frac{\omega^2}{\omega^4+5\omega^2+9}$ D. $\frac{\sin\omega}{\omega^2}$				

Q.No	Part – B (8 x 2 = 16 Marks) Answer any two questions	Marks	BL	CO	PO
5.	If $X(t) = Y \cos t + Z \sin t$ for all t where Y and Z are independent binary RVs, each of which assumes the values -1 and $+2$ with probabilities $\frac{2}{3}$ and $\frac{1}{3}$ respectively, prove that $\{X(t)\}$ is wide-sense stationary.	8	4	4	1,2
6.	A linear time invariant system has an impulse response $h(t) = e^{-\beta t}U(t)$, where $U(t)$ is the unit step function. Find the power spectral density of the output $Y(t)$ corresponding to the input $X(t)$.	8	4	5	1,2
7(i).	Find the variance of the stationary process $\{X(t)\}$, whose ACF is given by $R(\tau) = \frac{25\tau^2+36}{6.25\tau^2+4}$	4	3	4	1,2
7(ii).	Find the average power of the process $S_{XX}(\omega) = \frac{1}{4+\omega^2}$	4	3	5	1,2

Answer any two question

Part -- C (15 x 2 = 30 Marks)				
Answer any two question				
8.	Given a RV Y with characteristic function $\phi(\omega) = E\{e^{i\omega Y}\} = E\{\cos \omega Y + i \sin \omega Y\}$ and a random process defined by $X(t) = \cos(\lambda t + Y)$, show that $\{X(t)\}$ is stationary in the wide sense if $\phi(1) = \phi(2) = 0$.	15	4	4
9.	Find the mean square value of the process $S(\omega) = \frac{\omega^2 + 9}{\omega^4 + 5\omega^2 + 4}$	15	4	5
10(i).	If $\{X(t)\}$ is a WSS process with autocorrelation $R(\tau) = Ae^{-a \tau }$ determine the second order moment of the RV $X(8) - X(5)$.	8	3	4
10(ii).	The power spectral density function of a zero mean WSS process $\{X(t)\}$ is given by $S_{XX}(\omega) = \begin{cases} \pi, & \omega < 1 \\ 0, & \text{elsewhere} \end{cases}$. Find $R(\tau)$	7	3	5

Course Outcome (CO) and Bloom's level (BL) Coverage in Questions



Evaluation Sheet

Name of the Student:

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[illegible]

Part- A (4* 1= 4 Marks)			
Q. No	CO	Marks Obtained	Total
1	2		
2	2		
3	3		
4	3		
Part- B (8*2= 16 Marks)			
5	2		
6	3		
7(i)	2		
7(ii)	3		
Part- C (15*2= 30 Marks)			
8	2		
9	3		
10(i)	2		
10(ii)	3		

Consolidated Marks:

Detailed Marks:		Marks Scored
CO		
CO4		
CO5		