me of the Student:

gister No.:

R	A														

SRM

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-B

t: FT-IV
rse Code & Title: 21MAB203T-Probability and Stochastic Processes
r / Sem: II/IV

Date: 24/04/2024
Duration: 1 hr 40 Minutes.
Max. Marks: 50

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

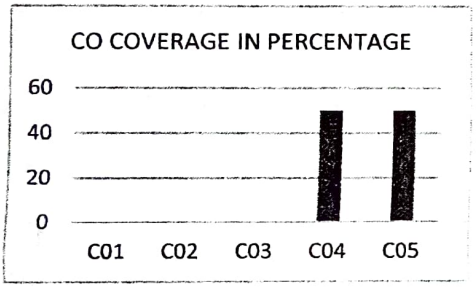
Part-A (1 x 4 = 4 Marks)
Answer ALL the Questions

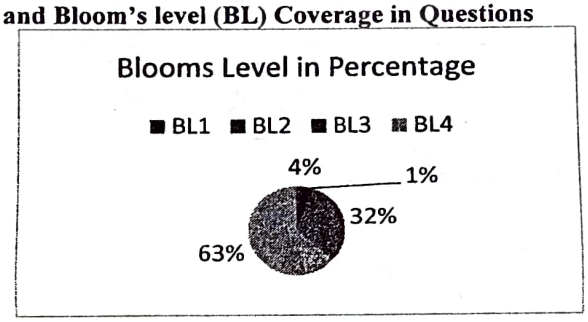
No	Question	Marks	BL	CO	PO
	Two random processes X(t) and Y(t) are said to be uncorrelated if their _____ is equal to the product of their means A. Auto correlation B. Cross correlation C. Power spectral density D. Cross power spectral density	1	1	4	1,2
	Which of the following is not a valid autocorrelation function? A. $R(\tau)=16+\frac{9}{1+6\tau^2}$ B. $R(\tau)=12+4e^{-2\|\tau\|}$ C. $R(\tau)=\frac{25\tau^2+36}{6.25\tau^3+4}$ D. $R(\tau)=16+4\cos(3\tau)$	1	2	4	1,2
	What does the spectral density function of any signal specify? A. Distribution of energy or power B. Consumption of energy or power C. Conservation of energy or power D. Generation of energy or power	1	1	5	1,2
	The relationship between autocorrelation function and power spectral density is given by A. Cauchy-Schwartz inequality B. Central limit theorem C. Tchebychev's inequality D. Weiner – Khinchine relation	1	1	5	1,2

No	Part – B (8 x 2 = 16 Marks) Answer any two questions	Marks	BL	CO	PO
	Show that the process $X(t) = A\cos\lambda t + B\sin\lambda t$ (where A and B are RVs) is wide-sense stationary if (i)$E(A) = E(B) = 0$ (ii)$E(A^2) = E(B^2)$ and (iii)$E(AB) = 0$	8	4	4	1,2
	If $R_{XX}(\tau) = \begin{cases} 1-\|\tau\|, in\ \|\tau\| \le 1 \\ 0,\ otherwise \end{cases}$, find power spectral density of X(t)	8	4	5	1,2
i).	Show that the random process $X(t) = A\cos(\omega_0 t + \theta)$ is first order stationary, if A and ω_0 are constants and θ is a uniformly distributed RV in $(0,2\pi)$.	4	3	4	1,2
ii).	Show that $S_{XY}(-\omega) = S_{YX}(\omega)$.	4	3	5	1,2

Part – C (15 x 2 = 30 Marks) Answer any two question					
8.	If $\{X(t)\}$ and $\{Y(t)\}$ are independent WSS processes with zero means, find the autocorrelation function of $\{Z(t)\}$, when (i) $Z(t) = a + bX(t) + cY(t)$, (ii) $Z(t) = aX(t)Y(t)$.	15	4	4	1,2
9.	A WSS process X(t) is the input to a linear system with impulse response $h(t) = 2e^{-7t}, t > 0$. If the autocorrelation function of X(t) is $R_{XX}(\tau) = e^{-4\|\tau\|}$,, find the power spectral density of the output process.	15	4	5	1,2
10(i).	A stationary process has an autocorrelation function given by $R(\tau) = 4 + e^{-\frac{\|\tau\|}{10}}$. Find the mean value, mean-square value and variance of the process.	8	3	4	1,2
10(ii).	The power spectral density function of a zero mean WSS process $\{X(t)\}$ is given by $S_{XX}(\omega) = \begin{cases} 1, & \|\omega\| < \omega_0 \\ 0, & elsewhere \end{cases}$. Find $R(\tau)$ and show also that $X(t)$ and $X\left(t + \frac{\pi}{\omega_0}\right)$ are uncorrelated	7	3	5	1,2

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





EVALUATION SHEET

Name of the Student:

Register No.:

R	A														

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:

CO	Marks Scored
CO4	
CO5	
Total	

Signature of the Course Teacher