SRM Institute of Science and Technology
College of Engineering and Technology
DEPARTMENT OF MATHEMATICS
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu

Mode of Exam
OFFLINE
SLOT-D1

Academic Year: 2021-2022

Test: CLA-3 **Date: 23/06/2022**
Course Code & Title: 18MAB203T / Probability and Stochastic Processes **Duration: 8.00 am-9.40 am**
Year & Sem: II & IV **Max. Marks: 50**

Course Articulation Matrix:

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	Compare the fundamentals between discrete and continuous random variables.	4	3	3										
CO2	Choose the model and analyze systems using two-dimensional random variables.	4	3	3										
CO3	Describe limit theorems using various inequalities.	4	3	3										
CO4	Interpret the characteristics of random processes.	4	3	3										
CO5	Evaluate problems on spectral density functions and linear time invariant systems.	4	3	3										
CO6	Explain how random variables and stochastic processes can be described and analyzed.	4	3	3										

Part – A (10 x 1= 10 Marks)
Answer all the questions

Q. No.	Question	Marks	BL	CO	PO	PI Code
1	If $R_{XX}(\tau) = \frac{4\tau^2 + 100}{\tau^2 + 4}$, then the mean of the stationary random process is (a) 2 (b) 4 (c) 3 (d) 9	1	2	4	1,2	1.2.2
2	A random process X(t) has four sample function: $X(t, s_1) = -\cos t$, $X(t, s_2) = -\cos t$ and $X(t, s_3) = \sin t$, $X(t, s_4) = -\sin t$, which are equally likely, then the mean value of {X(t)} is (a) -1 (b) 0 (c) 1 (d) 2	1	2	4	1,2	1.2.2

3	If X(t) and Y(t) are two random process and $R_{XX}(\tau)$ and $R_{YY}(\tau)$ are their respective autocorrelation function, then (a) $\lvert R_{XY}(\tau)\rvert \le \sqrt{R_{XX}(0)+R_{YY}(0)}$ (b) $\lvert R_{XY}(\tau)\rvert \ge \sqrt{R_{XX}(0)\,R_{YY}(0)}$ (c) $\lvert R_{XY}(\tau)\rvert \le R_{XX}(0)-R_{YY}(0)$ (d) $\lvert R_{XY}(\tau)\rvert \le \frac{1}{2}[R_{XX}(0)+R_{YY}(0)]$	1	1	4	1,2	1.2.2
4	If the random process Z(t)=X(t)+Y(t), where X(t) and Y(t) are random process then, $R_{ZZ}(\tau)$ is (a) $R_{XX}(\tau)+R_{YY}(\tau)+R_{XY}(\tau)+R_{YX}(\tau)$ (b) $R_{XX}(\tau)+R_{YY}(\tau)$ (c) $R_{XY}(\tau)+R_{YX}(\tau)$ (d) $R_{XX}(\tau)+R_{YY}(\tau)+R_{XY}(\tau)$	1	2	4	1,2	1.2.2
5	If the autocorrelation function $R_{XX}(\tau)=75e^{-10\lvert\tau\rvert}+25\cos\tau+49$, then the average power of the random process is (a) 49 (b) 149 (c) 249 (d) 349	1	1	4	1,2	1.2.2
6	If the power spectral density of a WSS process is given by $S_{XX}(\omega)=\begin{cases}\pi, \lvert\omega\rvert<1,\\ 0, \text{otherwise},\end{cases}$ then $R_{XX}(\tau)$ is (a) $\frac{\cos\tau}{\tau}$ (b) $\frac{\sin\tau}{\tau^2}$ (c) $\tau^2\sin\tau$ (d) $\frac{\sin\tau}{\tau}$	1	2	5	1,2	1.2.2
7	Real part of $S_{XY}(\omega)$ is an (a) Odd function (b) even function (c) neither even nor odd (d) trail function	1	1	5	1,2	1.2.2
8	If the power spectral density of a WSS process is $S_{XX}(\omega)=\frac{6}{9+\omega^2}$, then $R_{XX}(\tau)$ is (a) $e^{-2\lvert\tau\rvert}$ (b) $e^{-3\lvert\tau\rvert}$ (c) $e^{-4\lvert\tau\rvert}$ (d) 1	1	2	5	1,2	1.2.2
9	If $Y(t)=f[X(t)]$ is time invariant system then for $\tau\in(-\infty,\infty)$, $Y(t+\tau)$ = (a) $f[X(t)]$ (b) $f[X(t-\tau)]$ (c) $f[X(t+\tau)]$ (d) $f[X(t+n\tau)]$	1	1	5	1,2	1.2.2

10	The mean square value of the process whose power spectral density $S_{xx}(\omega) = \frac{2}{1+\omega^2}$ is (a) 0 (b) 1 (c) -1 (d) 2	1	2	5	1,2	1.2.2

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Part-B (4 x 10= 40 Marks)

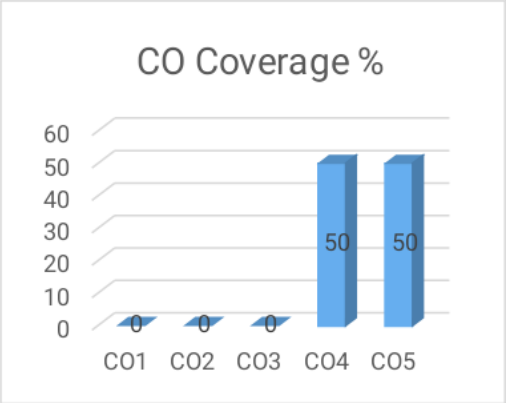
Answer Any TWO Questions

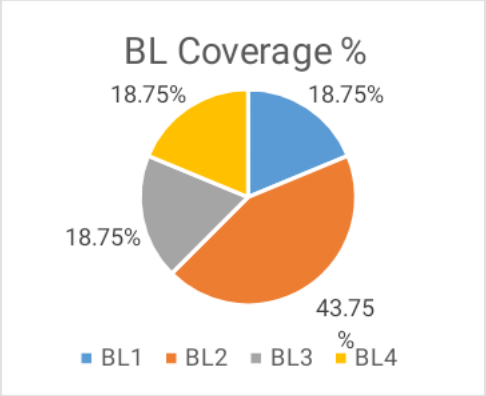
11	Given a random variable Y with characteristic function $\phi(\omega) = E[e^{j\omega Y}]$ and a random process $X(t) = \cos(\lambda t + Y)$, show that $X(t)$ is stationary in the wide-sense if $\phi(1) = \phi(2) = 0$.	10	3	4	1,2	2.8.1
12	If $\{X(t)\}$ is a WSS process with autocorrelation function $R_{xx}(\tau)$ and if $Y(t) = X(t+a) - X(t-a)$, show that $R_{YY}(\tau) = 2R_{xx}(\tau) - R_{xx}(\tau+2a) - R_{xx}(\tau-2a)$.	10	3	4	1,2	2.8.1
13	Consider the two random process $X(t) = 3\cos(\omega t + \theta)$ and $Y(t) = 2\sin(\omega t + \theta)$, where θ is uniformly distributed in $(0, 2\pi)$. Prove that $\lvert R_{xy}(\tau)\rvert \le \sqrt{R_{xx}(0)R_{yy}(0)}$.	10	4	4	1,2	2.8.1

Answer Any TWO Questions

14	If the power spectral density of a WSS process is given by $S_{xx}(\omega) = \begin{cases} \frac{b}{a}(a - \lvert\omega\rvert), \lvert\omega\rvert \le a, \\ 0, \text{otherwise}, \end{cases}$ compute $R_{xx}(\tau)$.	10	3	5	1,2	2.8.1
15	Determine the power spectral density of the random process, if its autocorrelation function is given by $R_{xx}(\tau) = e^{-\lambda\lvert\tau\rvert}\cos\beta\tau$.	10	4	5	1,2	2.8.1
16	A random process X(t) is the input to a linear system whose impulse response is $h(t) = 2e^{-t}, t \ge 0$. If the $R_{xx}(\tau) = e^{-2\lvert\tau\rvert}$, Determine the power spectral density of the output process Y(t).	10	4	5	1,2	2.8.1

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





Evaluation Sheet

Name of the Student:

Register No.

R	A													

Part - A (10X1=10 Marks)			
Q. No	CO	Marks Obtained	Total
1	4		
2	4		
3	4		
4	4		
5	4		
6	5		
7	5		
8	5		
9	5		
10	5		
Part- B (4x10= 40 Marks)			
Answer any two questions			
11	4		
12	4		
13	4		

Answer any two questions			
14	5		
15	5		
16	5		

Consolidated Marks:

CO	Marks Scored
CO4	
CO5	
Total	

Signature of the Course Teacher