Register No.: R A

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

C2-Slot
SET-B

Test: FT-IV | Date: 24/04/2024
Course Code & Title: 21MAB203T-Probability and Stochastic Processes | Duration: 1 hr 40 Minutes.
Year / Sem: II/IV | Max. Marks: 50

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.	The maximum value of $R_{XX}(\tau)$ is obtained at the point (a) $\tau=0$ (b) $\tau=1$ (c) $\tau=\infty$ (d) $\tau=-\infty$	1	1	4	1,2
2.	The ___ of the random process $\{X(t)\}$ is the expected value of the random variable X at time t (a) time average (b) ensemble average (c) variance (d) average power	1	1	4	1,2
3.	The value of the spectral density function at zero frequency is equal to the total area under the graph of the (a) autocorrelation function (b) spectral density function (c) cross power spectral density (d) cross correlation function	1	1	5	1,2
4.	A linear time invariant system is said to be _____ if its response to any bounded input is bounded. (a) unstable (b) transient (c) stable (d) saturated	1	1	5	1,2

Part – B (8 x 2 = 16 Marks)
Answer any two questions

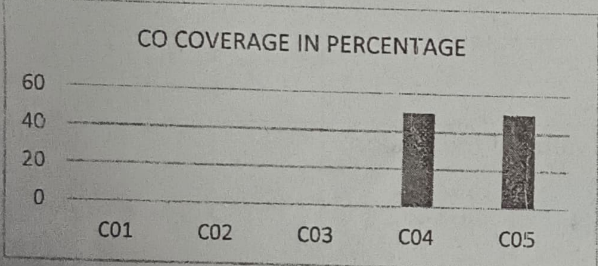
Q. No	Question	Marks	BL	CO	PO
5.	If $\{X(t)\}$ is a WSS process with autocorrelation function $R_{XX}(\tau)$ and if $Y(t)=X(t+a)-X(t-a)$ show that $R_{YY}(\tau)=2R_{XX}(\tau)-R_{XX}(\tau+2a)-R_{XX}(\tau-2a)$.	8	2	4	1,2
6.	If the PSD of a WSS process is given by $S_{XX}(\omega)=\left\{\begin{array}{ll}\frac{b}{a}(a-\lvert\omega\rvert) & \lvert\omega\rvert\le a\\ 0 & otherwise\end{array}\right\}$ find the autocorrelation of the process.	8	4	4	1,2
7(i).	Find the mean and variance of the process given by $R_{XX}(\tau)=25+\frac{4}{1+\tau^2}$	4	3	5	1,2
7(ii).	Examine whether the following system is time invariant: $y(t)=t\,x(t)$.	4	3	5	1,2

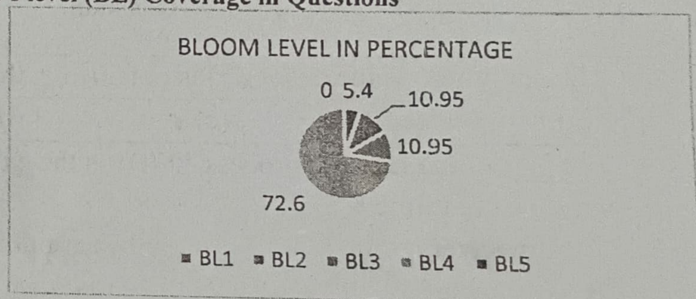
Part – C (15 x 2 = 30 Marks)

Answer any two question

8.	Consider two random processes X(t)= 3 cos(ωt + θ) and Y(t)=2cos(ωt + θ - π/2) where θ is a random variable uniformly distributed in (0, 2π). Prove that $\sqrt{R_{XX}(0)R_{YY}(0)} \geq \lvert R_{XY}(\tau)\rvert$.	15	4	4	1,2
9.	Given the PSD Sxx(ω) = $\frac{157+12\omega^2}{(16+\omega^2)(9+\omega^2)}$ find the average power.	15	4	4	1,2
10(i).	The process {X(t)}, whose probability distribution under certain conditions is given by $P\{X(t)=n\} = \frac{(at)^{n-1}}{(1+at)^{n+1}}, n=1,2,\ldots$ $= \frac{at}{1+at}, n=0$ Show that it is not stationary.	8	4	5	1,2
10(ii).	A circuit has unit impulse response given by $h(t)=\begin{cases}\frac{1}{T} & 0\leq t\leq T\\ 0 & otherwise\end{cases}$ Evaluate $S_{YY}(\omega)$ in terms of $S_{XX}(\omega)$.	7	4	5	1,2

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





Name of the Student:

Register No.:

R	A														

Evaluation Sheet

Q. No	CO	Marks Obtained	Total
Part- A (4* 1= 4 Marks)			
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	