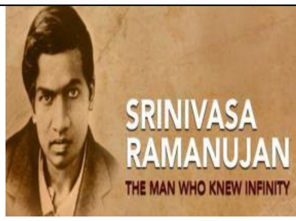
SRM Institute of Science and Technology
Kattankulathur

DEPARTMENT OF MATHEMATICS

18MAB203T- Probability and Stochastic Processes

Module – IV
Tutorial Sheet - 12



Sl.No.	Questions	Answer
	Part – B	
1	Suppose that X(t) is a process with mean $\mu(t)=3$ and autocorrelation $R_{XX}(\tau)=9+4e^{-0.2\|\tau\|}$. Determine the mean, variance and the covariance of the random variables Z = X (5) and W = X (8)	(i) 3 (ii) 3 (iii) 4 (iv) 4 (v) 2.19
2	Two random processes X(t) and Y(t) are given by $X(t)=A\cos(\omega t+\theta)$, $Y(t)=A\sin(\omega t+\theta)$, where A and ω are constants and θ is a uniform random variable over (0,2π). Find the cross-correlation function of X(t) and Y(t)	
3	Prove that the cross-correlation function of two jointly WSS random processes $X(t)=A\cos(\omega t+\theta)$, and $Y(t)=A\cos(\omega t+\theta+\varphi)$, is given by $R_{XY}(\tau)=\frac{AB}{2}\cos(\omega\tau+\varphi)$. Find the value of φ when X(t) and Y(t) are orthogonal.	
	Part-C	
4	If $U(t)=X\cos t+Y\sin t$,and $V(t)=Y\cos t+X\sin t$ where X and Y are independent RV’s such that, $E(X)=E(Y)=0;\ E(X^2)=E(Y^2)=1,$ show that {U(t)} and {V(t)} are individually stationary in the wide sense, but they are not jointly wide-sense stationary	
5	Two random variables are defined by $X(t)=A\cos\omega t+B\sin\omega t$ and $Y(t)=B\cos\omega t-A\sin\omega t$ where A and B are random variables and ω is a constant. we can show that X(t) and Y(t) are wide sense stationary if A and B are uncorrelated zero mean random variables with same variance. Prove that X(t) & Y(t) are jointly wide sense stationary, finding the cross-correlation function.	$R_{XY}(\tau)=-\sigma^2\sin\omega\tau$
6	If $X(t)=5\cos(10t+\theta)$ and $Y(t)=20\sin(10t+\theta)$ where θ is a RV uniformly distributed in (0, 2π), prove that the processes {X(t)} and {Y(t)} are jointly wide-sense stationary.	
7	Find the cross-correlation function of $w(t)=A(t)+B(t)$ & $Z(t)=A(t)-B(t)$ where A(t) & B(t) are statistically independent random variable with Zero mean and	$R_{WZ}(\tau)=-2e^{-\|\tau\|}$

	autocorrelation function respectively	$R_{AA}(\tau) = e^{-\lvert\tau\rvert} \quad -\infty < \tau < \infty$ $R_{BB}(\tau) = 3e^{-\lvert\tau\rvert} \quad -\infty < \tau < \infty$	