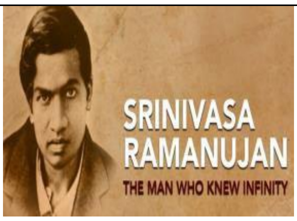
SRM Institute of Science and Technology
Kattankulathur

DEPARTMENT OF MATHEMATICS

18MAB203T Probability and Stochastic Processes

Module – IV
Tutorial Sheet - 10



Sl.No.	Questions	Answer
	Part – B	
1	The Probability distribution of the process $\{X(t)\}$ is given by $P(X(t)=n)=\begin{cases} \dfrac{(at)^{n-1}}{1+(at)^{n+1}} & , \quad n=1,2......... \\ \dfrac{at}{1+at} & n=0 \end{cases}$ Show that $\{X(t)\}$ is not Stationary	$E(X(t))=1$, constant $V(X(t))=2at$, Which depends on t
2	Verify whether the random process $X(t)=y\sin wt$ is a WSS or not, where y is uniformly distributed in (-1,1).	(i) $E(X(t))=0$, (ii) $R_{XX}(t,t+\tau)$ depends on t, X(t) is not WSS
3	Consider the random process $\{X(t)=Y\cos wt,\ t\ge 0\}$,where w is a constant and Y is a uniform random variable over (0,1). Find the auto correlation function $R_{XX}(t_1,t_2)\ of\ X(t)$ and covariance $C_{XX}(t_1,t_2)\ of\ X(t)$	(i) $R_{XX}(t_1,t_2)=\frac{1}{3}\cos wt_1\cos wt_2$ (ii) $C_{XX}(t_1,t_2)=\frac{1}{12}\cos wt_1\cos wt_2$
4	If $X(t)=A\cos\lambda t+B\sin\lambda t$,where A and B are two independent normal random variables with $E(A)=E(B)=0$, $E(A^2)=E(B^2)=\sigma^2$,and λ is a constant, Prove that $\{X(t)\}$ is a strict sense stationary process of order 2.	
	Part – C	
5	Given a random variable y with characteristic function $\phi(w)=E(e^{iwy})$ and a random process defined by $X(t)=\cos(\lambda t+y)$ .Show that $\{X(t),t\in T\}$ is WSS if $\phi(1)=\phi(2)=0$.	(i) $E(X(t))=0$ (ii) $R_{XX}(t_1,t_2)=\left(\frac{1}{2}\cos\lambda(t_1-t_2)\right)$
6	Given a random variable Ω with density $f(w)$ and another random variable ϕ uniformly distributed in $(-\pi,\pi)$ and independent of Ω and $X(t)=a\cos(\Omega t+\phi)$ .prove that $\{X(t),t\in T\}$ is a WSS process.	
7	Consider a random process $Y(t)=X(t)\cos(wt+\theta)$, where X(t) is a WSS random Process, θ is a random variable independent of X(t) and is distributed uniformly in $(-\pi,\pi)$	

	and w is a constant. Prove that Y(t) is WSS.	
8	If $X(t) = Y\cos t + Z\sin t$ for all t where Y and Z are independent binary random variables, each of which assumes the values -1 and 2 with probabilities $\frac{2}{3}$ & $\frac{1}{3}$ respectively, prove that $\{X(t), t \in T\}$ is WSS & not strict sense stationary.	(i) $E(X(t)) = 0$ $R_{XX}(t_1,t_2) = 2\cos(t_1 - t_2)$ (ii) $E(X^3(t) = -2\cos^3 t - 2\sin^3 t$ Which is a function of t
9	If the random process $X(t)$ defined by $X(t) = \sin(\omega t + y)$ Where y is a random variable uniformly distributed in the interval $(0, 2\pi)$ .prove that for the process X(t), $C(t_1, t_2) = R(t_1, t_2) = \frac{\cos\omega(t_1 - t_2)}{2}$.	