**King Fahd University of Petroleum & Minerals**

**Serial # 0**

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Electrical Engineering Department

EE315: Probabilistic Methods in Electrical Engineering (112)

**Quiz 7: Random Processes-Temporal Characteristics**

Name: KEY

For a stationary ergodic random process having the autocorrelation function shown in the Figure , find:

a) $E\left[X\left(t\right)\right]=\sqrt{R\_{XX}\left(τ→\infty \right)}=\sqrt{20}$

b) $E\left[X^{2}\left(t\right)\right]$=$R\_{XX}\left(0\right)=50$

c) $σ\_{X}^{2}=50-20=30$

Statistically independent zero mean random processes $X\left(t\right)$ and $Y\left(t\right)$ have auto correlation function $R\_{XX}\left(τ\right)=e^{-\left|τ\right|}$ and $R\_{YY}\left(τ\right)=cos⁡(2πτ)$.

Find the autocorrelation function of $W\left(t\right)=X\left(t\right)+2Y\left(t\right)+1$

$$E\left[\left\{X\left(t\right)+2Y\left(t\right)+1\right\}\left\{X\left(t+τ\right)+2Y\left(t+τ\right)+1\right\}\right]=R\_{XX}\left(τ\right)+2R\_{XY}\left(τ\right)+\overbar{X}+4R\_{YY}\left(τ\right)+2R\_{YX}\left(τ\right)+2\overbar{Y}+\overbar{X}+2\overbar{Y}+1=R\_{XX}\left(τ\right)+4R\_{YY}\left(τ\right)+1$$

$=e^{-\left|τ\right|}+4 cos⁡(2πτ)$+1

Note that the means are zeros and because of independence the cross correlation is 0

 Good Luck, **Dr. Ali Muqaibel**