R09

Code No: C4504

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I - Semester Examinations March/April-2011
RANDOM PROCESSES AND TIME SERIES ANALYSIS
(SYSTEMS AND SIGNAL PROCESSING)

Time: 3hours **Max.Marks:60**

Answer any five questions
All questions carry equal marks
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1. a) A random process is defined as X(t)=Cosλt, where "λ" is a constant and 'A" is a uniform Random Variable over (0,1). Find the Auto correlation and Auto Covariance of X(t).
   b) A random process is defined as X(t)=A.Cos(100t+θ), where "A" is a normal Random variable with zero mean and unity Variance, and "θ" is a uniform random variable over (-π,π), and is independent of "A". Find the Auto correlation function of X(t). [6+6]

2. If X(t) is a Wide sense stationary process with a mean of 2 and of Auto correlation function Rxx(k)= 4+exp(-0.1|k|), find the mean and variance of Y(t)= integral of X(t) , with respect to "t" over(0,1). [12]

3. If X(t) is a Poisson process with mean"λt" and of M.S. value"$\lambda t+ (\lambda t)^2$", verify that its Auto correlation function is $Rxx(t_1,t_2)= \lambda t_1(1+\lambda t_2)$ for $t_2>t_1$
   $= \lambda t_2(1+\lambda t_1)$ for $t_1>t_2$., where t_1,t_2 are two sampling instants of the process. [12]

4. a) Find and plot the Autocorrelation function of the output of an RC LPF, if the input process is a random process with PSD "K".
   b) Find the PSD of a Random Process X(t)=A.Cos(Bt+Y), where "Y" is a uniform random Variable over (0,2π). [6+6]

5. a) A random Process X(t) with auto correlation function of R(k)=P.exp(-β|k|), where "P" and "β" are real constants is applied to the input of a system with impulse response h(t)= Z.exp(-Zt) .U(t), where "Z" is a real constant. Find the Auto correlation function of the system's response Y(t).
   b) If X(t) and Y(t) are the input and output stationary processes of an LTI system with impulse response h(t), prove that their cross correlation is given by the convolution of h(t) and the auto correlation of X(t). [6+6]

6. Prove that the Cross Correlation function and Cross Spectral Density of two Stationary Random Processes form a Fourier Transform Pair. [12]

7. a) a) State the Properties of Markov Chains.
   b) A game of chance has a probability "p" of winning and probability "q = 1-p" of losing. If a gambler wins, the house pays him a dollar and if he loses, he pays the house, the same amount. The gambler, who initially has 2 dollars, decides to play until he is either broke or doubles his money. If the gambler loses his last dollar, the house gives him, another one. Represent the activity by Markov Chain, by giving the corresponding state diagram and Transition Matrix. 8M

8. Expalin about M/M/1 queues. [12]

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