R09

Code No: C9303

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I - Semester Examinations, March/April -2011
RANDOM PROCESS AND TIME SERIES ANALYSIS
(SYSTEMS & 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 $X(t)=A. \cos(\omega t+\theta)$, where "$\theta$" is a uniform random variable over $(0,2\pi)$. Check the process for ergodicity in the Mean sense and Auto correlation sense.
b) State and prove the Properties of Auto correlation function of a Stationary Random Process. [6+6]

2.a) "A" and "B" are two uncorrelated, zero mean random variables with same variance and "ω" is a constant. Verify that the random processes $X(t)=A.\cos\omega t+B.\sin\omega t$ and $Y(t)=A. \cos\omega t-B. \sin\omega t$ are jointly stationary.
b) A random Process X(t) is defined as $X(t)=A.\cos 2\pi f_c t$, where "A" is a Gaussian Distributed random variable with zero mean and Variance σ^2. This random process X(t) is applied to an ideal integrator , which integrates X(t) between (0,t). Check the output process of the integrator for stationarity and Ergodicity. [6+6]

3. Derive the expression for the density of two jointly Gaussian random Variables. [12]

4. State and Prove Wiener-Khintchine Relation for a Stationary Random Process. [12]

5. a) State and Prove the Properties of PSD of a Stationary Random Process.
b) Verify that if X(t) and Y(t) are two independent Random Processes with constant mean, their Cross Spectral Density is an Impulse Function. [8+4]

6.a) A White noise process with PSD of "K" w/Hz is applied to an ideal Band Pass Filter with system function defined as $H(w)= 1$ for $|w|\leq Wc-Wm$, where Wc is the center frequency. Find and plot the Autocorrelation function of the output of the filter.
b) White Noise with PSD "η" is passed through an RC LPF, and then through an ideal amplifier which provides a gain of 10. Find the Mean square value of the output of the amplifier. [6+6]

7.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. If the gambler, who initially has 2 dollars, decides to play until he is either broke or doubles his money, represent the activity by Markov Chain, by giving the corresponding state diagram and Transition Matrix. [12]

8. Prove that the sum of two independent Poisson processes is also a Poisson Process, but their difference is not. [12]

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