Subject Code: C9512

M.Tech - I Semester [R09] Regular/Supplementary Examinations, April - 2012

RANDOM VARIABLES & STOCHASTIC PROCESS

(Control Systems)

Time: 3 Hours **Max Marks: 60**

Answer any FIVE questions. All questions carry EQUAL marks.

1. a. State and Prove Bayes Theorem.
   b. Present the axiomatic approach of probability. (6M+6M)

2. a. Obtain the variance of a uniformly distributed random variable.
   b. Prove that $f_X(x/X \leq b) = \begin{cases} \frac{f_X(x)}{\int_{-\infty}^{b} f_X(a)dx} & x < b \\ 0 & x \geq b \end{cases}$ (6M+6M)

3. a. If X is a zero mean Gaussian random variable find the density of $Y = CX^2$, where C is a real constant >0
   b. Show that characteristic functional Gaussian Random variable is $e^{-\left(\frac{\sigma_X^2\omega^2}{2}\right)}$ (6M+6M)

4. a. X and Y are statically independent random variables and W= X+Y. Find the density of 'W'
   b. The radial "miss –distance" of landings from parachuting sky drivers, as measured from a target's center, is a Rayleigh random variable with b= $800m^2$ and a =0. The target is a circle of 50m radius with a bull's eye of 10m radius. Find the probability of a parachute hitting the bull's eye given that the landing is on the target. (6M+6M)

5 a. Define random process and present the detailed classification of random processes.
  b. Explain stationarity in strict and weak sense using necessary relations. (6M+6M)

6 a. $R_{XX}(\tau)$ is the autocorrelation function of a WSS random process where $R_{XX}(\tau) = 25 + (4 / (1+6\tau^2))$, find mean & variance of X(t).
  b. Write the necessary conditions for a random process to be ergodic.
  c. State and prove any two properties of autocorrelation function. (5M+2M+5M)

7. a. State & Prove Wiener – Khintchine relations.
   b. Given $R_{XX}(\tau) = (A_0^2/2) \cos \omega_0 \tau$, Find $S_{XX}(\omega)$ (9M+3M)

8. Write notes on :
   a. Bandlimited random process.
   b. Effective noise temperature.
   c. Average noise figure. (4+4+4)

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