

STOCHASTIC CONTROL (CON)

Time : 3 Hours

Full Marks : 100

Answer Q.1 and Any Four from rest

1. Select the correct answer:
- Probability Distribution function $F_X(X)$ is defined as 4x5
 A. $F_X(X) = P(X \leq x)$ B. $F_X(X) = P(X \geq x)$ C. $F_X(X) = P(X = x)$
 - An experiment involves tossing of a coin; here set of all possible outcome is called
 A. Nyquist Space B. Random Space C. Sample Space
 - Two random variables X_i & Y_j are uncorrelated if
 A. $E(X_i Y_j) = E X_i E Y_j$ B. $E(X_i Y_j) = E X_i(Y_j) E Y_j(X_i)$ C. $E(X_i Y_j) = E X_i E Y_j(X_i Y_j)$
 - Bayes Rule is
 A. $f(Y | X) = f(X, Y) / f(X)$ B. $f(Y | X) = f(Y, X) / f(X)$ C. $f(Y | X) = f(X, Y) / f(Y)$
 - A stochastic process $\{x(t); t \in I\}$ is Gauss_Markov if it is
 A. only Gaussian B. only Markov C. Both Gaussian-Markov
2. a. What is a Stochastic process (SP) 4+8+8
 b. State the properties of SP
 c. Define Random Variable
3. Define the following 4x5
 a. Probability Density Function
 b. Joint Probability Density Function
 c. Joint Probability Distribution Function (1/ π) for $x^2 + y^2 \leq 1$
- d. Assume x and y are scalars whose joint density function is cylindrical : $f(x, y) = \begin{cases} (1/\pi) & \text{for } x^2 + y^2 \leq 1 \\ 0 & \text{elsewhere} \end{cases}$
4. a. What is Gauss-Markov Stochastic Process 8+12
 b. A scalar process $\{x(t); t \geq 0\}$ defined by differential eq. $\{dx(t)/dt\} = -x(1 - 2t)$.
 verify if the process is Gauss-Markov
5. a. Define : (i) Random Binary Transmission (ii) Semi-Random Binary Transmission 4+4+12
 b. Autocorrelation of a random signal $y(t)$ is $R(t) = \exp(-t)$; Derive an expression for its spectrum $S(\omega)$
6. a. State the Prediction Problem 8+12
 b. Explain the Weiner-Hopf integral equation if its impulse response is $h(\tau)$
7. a. What is Kalman Gain-Matrix 8+12
 b. State and explain the Kalman Filter Algorithm
8. Write Short Note (Any Two) 2x10
 a. Estimation Error
 b. Interpolation Problem
 c. Expectation value $E[g(x)]$
 d. Characteristic function $\phi_b(s)$