M.E. Electronics & Telecommunication Engineering   **First Year Second Semeseter-2017**

STOCHASTIC CONTROL (CON)

Time : **3 Hours**   Full Marks : **100**

Answer Q.1 and <u>Any Four</u> from rest

1. Indicate True (T)/ False(F) :   5x4

a. Probability P(x) of an event-x is $P(x) = [N/ N(x)] @ N \rightarrow 0$; N is number of trials for True-x

b. Loss function of an incorrect estimate is $L' = L [x' (k \mid j]$

c. Given a Random vector (X) and arbitrary vector (x); Probability distribution function of X is $F(X) = P(X \geq x)$

d. If ensemble of a stochastic process has countable number of elements then it is defined as Chain

e. Ensemble of a stationary stochastic process is invariant to time.

2. a) Define Joint Probability Density Function   8+12

b) Random variable (x) is uniformly distributed in $[\alpha, \beta]$ interval with distribution function

$$F(X) = \begin{cases} \rightarrow 0 & ; x < \alpha \\ \rightarrow (x - \alpha)(\beta - \alpha) & : \alpha \leq x \leq \beta \\ \rightarrow 1 & ; \beta < x \end{cases}$$

Derive the Density Function

3. a) What is Prediction Problem   8+12

b) Explain it in terms of Impulse Response $h(\tau)$ using Weiner Hopf- integral equation.

4. a) A real process x(t) has mean $m(t)$ and Autocorrelation $R(t_1, t_2)$. Derive a condition on how Cross-Correlation between two such similar real processes x(t) and y(t) will satisfy.   10+10

b) A simple RC circuit is connected to a voltage V(t); Show how to calculate Autocorrelation of V(t) ; apply usual assumption

5. Explain with suitable example: a) Estimation Error   b) Interpolation problem   6+6+8
c) formulation of Kalman Filter

6. a) What is Gauss-Markov Stochastic Process   10+10

b). A scalar process $[x(t) ; t \geq 0]$ defined by differential equation $(dx(t)/dt) = -0.5 \, x/ (1 - 2t)$: Is the process Gauss-Markov; assume $x(t)$ Gaussian Random @ mean = 0.

7. What is meant by : (a) Properties of a stochastic process. (b) Difference between   10+10
continuous time stochastic Chain and discrete time stochastic Chain

8. Short Note : Any Two   10x2
a) Mean Value Function   b) Smoothing Filter
c) Definition of Wiener-Hopf Integral Equation   d) Random Binary transmission.