M.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING

FIRST YEAR SECOND SEMESETER-2018

STOCHASTIC CONTROL (CON)

Time : 3 Hours | Full Marks : 100

Answer Q.1 and Any Four from rest

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

10x2

a. Probability P(x) of event-x is : $P(x)= [N/N(x)] \mid N \to 0$

b. If X is a random vector and x is arbitrary vector, then Probability Distribution Function of X is $F_x(X)= P(X \geq x)$

c. Experiment on measuring a frequency component in given spectra is carried out; all possible results of the measurement is defined as Random Vector Space

d. Conditional Probability Distribution of X and Y is $F(x \mid Y=y) = P(X=x \mid Y=y)$

e. Joint Probability Density Function is $[\{\delta^{n+m} F\} / \{(\delta x_1 \ldots\ldots \delta x_n)(\delta y_1 \ldots\ldots \delta y_n)\}]$

f. Loss function of an incorrect estimate is $L = L\{|x^2|(k \mid j)\}$

g A stochastic process is Gauss-Markov, if it is only partially Markov and Full Gaussian

h. If Ensemble of stochastic process has countable number of elements, then it is a Chain

i. Covariance Matrixof uncorrelated random vectors is Diagonal

j. Gaussian Random Vectors are uncorrelated and independent

2. (a) Define

(i) Joint Probability Distribution Function (JPD) 5+5

(ii) Conditional Probability density Function (CPD)

(b) Given two scalars X and Y having cylindrical JPD as 10

$$f\{x, y\} = \begin{cases} 1/\pi & : x^2+y^2 \leq 1 \\ 0 & : \text{elsewhere} \end{cases}$$

Using Baye's Rule, derive CPD for Y= 0 ; sketch the function

3. a) What is a Stochastic Process; state the properties 6 +6 +8
   b) Explain difference between continuous-time & discrete-time stochastic process
   c) What are properties of Covariance Kernel

4. a) What is a Gauss-Markov Stochastic Process 8+12
   b) A scalar process { x(t); t ≥0 } defined by differential eq. dx/dt = − x (1 − t); assuming x(t) is Gauss-Random with mean= 0 & variance >0 , verify the process as Gauss-Markov or Not.

5. a) Define (i)Random Binary Transmission (ii) Semi-random binary transmission 5+5
   b) Auto-correlation of a random signal y(t) is R(τ)= exp.(− b τ); Derive an expression for its spectrum S(ω) and show its typical frequency response. 10

6. a) What is **(i)** Continuous-time stochastic process **(ii)** Sampled data stochastic process 5+5
   b) A scalar process { x(t); t ≥0 } with x(t) = *A cosine t* is a continuous random variable that is uniformly distributed between ±1 . Obtain the ensemble representation 10

7. a) What is Prediction Problem 8
   b) State Wiener- Hopf integral equation; explain in terms of Impulse response h(τ) 12

8. Write Short Note (any **two**) 10x2

   (a) Orthogonal process
   (b) Smoothing filter
   (c) Recursive filter
   (d) Interpolation
   (e) Kalman Gain Matrix

.... x ....