Department of Civil Engineering
Indian Institute of Technology Guwahati

CE-607 ASSIGNMENT-1 (RANDOM PROCESS)

Due date:	Saturday Feb-1, 2020 by 12-30.pm (Noon)

Question-1) 40 marks

Sinusoid with uniform amplitude, frequency, and phase. Find the autocorrelation function $\boldsymbol{R_x(t, t+\tau)}$ of the continuous random process ***X(t)*** = $\boldsymbol{A\,cos\,(\omega t + \phi)}$where $\boldsymbol{\omega, A}$ and $\boldsymbol{\phi}$ are mutually independent RVs uniformly distributed over **(1,2), (0,1),** and $(0, \frac{\pi}{2})$ respectively.

Question-2) 30 marks

First-order polynomial in time with random coefficient. Given a random process $\boldsymbol{X(t) = Y + Z\,t}$ where ***Y*** and ***Z*** are two standard Gaussian RVs, independent of each other, find

(a) the mean and variance of $\boldsymbol{X(t)}$

(b) the marginal PDF and CDF of $\boldsymbol{X(t)}$

(c) the joint CDF of $X(t)$: $F_{X(t_1),X(t_2)}(x_1, x_2)$

Question-3) 20 marks

Consider the vector random variable Y given by

$Y = \{Y_1 \quad Y_2 \quad Y_3\}^t$. It is given that Y is normal with

mean vector μ and correlation matrix R given by

$$\mu = \begin{Bmatrix} 1 \\ 2 \\ 3 \end{Bmatrix} \text{ and } R = \langle YY^t \rangle = \begin{bmatrix} 4 & -1 & 6 \\ -1 & 9 & 0 \\ 6 & 0 & 19 \end{bmatrix}.$$

We now form the random process

$X(t) = Y_1 + Y_2 t + Y_3 t^2$.

Find the mean, variance and the autocorrelation of X(t)

<u>Question-4</u>) 10 marks

Consider a random process $X(t)$ defined by

$$X(t) = U\cos t + V\sin t \qquad -\infty < t < \infty$$

where U and V are independent r.v.'s, each of which assumes the values -2 and 1 with the probabilities $\frac{1}{3}$ and $\frac{2}{3}$, respectively. Show that $X(t)$ is WSS but not strict-sense stationary.