**Department of Mathematics**

**Odd Semester 2017**

**Probability and Random Processes** **15B11MA301**

**Probability and Random Processes** **10B11MA411**

**Tutorial Sheet 7** **B.Tech. Core**

**Random Process**

**1.** Define a random process and classify them with suitable examples.

**2.** In an experiment of two fair dice, the process $\{X(t)\}$ is defined as $X(t) = \sin\pi t$ , if the experiment shows a prime sum and $X(t) = 2t + 1$, otherwise. Find the mean of the process. Is the process stationary? [Ans: not stationary]

**3.** Let $X(t) = A\cos\lambda t + B\sin\lambda t$ , with random variable A taking values 1 and 3 with equal probabilities and random variable B taking values -1 and 1 with probabilities ¼ and ¾ respectively. Test the process $\{X(t)\}$ for stationarity. [Ans: not stationary]

**4.** Test the random processes $\{X(t)\}$ and $\{Y(t)\}$ for WSS when:

(i) $X(t) = \cos(\lambda t + Y)$, where $\lambda$ is a constant and Y is uniform in $(0, 2\pi)$
[Ans: WSS]

(ii) $Y(t) = X\sin(\lambda t)$, where $\lambda$ is a constant and X is uniform in $(-1, 1)$.
[Ans: not WSS]

**5.** Find auto correlation functions of the processes $\{X(t)\}$ and $\{Y(t)\}$ such that $X(t) = A\cos\lambda t + B\sin\lambda t$ and $Y(t) = B\cos\lambda t - A\sin\lambda t$ , where A and B are uncorrelated random variables taking value -4 and 4 with equal probabilities. Prove that $\{X(t)\}$ and $\{Y(t)\}$ are jointly WSS.

**6.** Given a random variable Y with characteristic function $\phi(2w) = E(e^{iwY})$ and a random process defined by $X(t) = \cos(3t + 2Y)$. Find the condition under which the process $\{X(t)\}$ is WSS. [Ans: $\phi(4) = \phi(8) = 0$]

**7.** If $\{X(t)\}$ is a WSS process with $E\{X(t)\} = 2$ and $R_{XX}(\tau) = 4 + e^{-|\tau|/10}$, find the variance of X(1), X(2) and X(3). Also compute the second order moment about origin of X(1) + X(2) + X(3).

**8.** Define a Random walk and prove that the limiting form of a random walk is Wiener process.