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**Department of Electronics and Telecommunication**  
**Subject: Digital Communication** **Class: TE (E&TC)**

**ASSIGNMENT 1: Random Processes & Noise**

Que. No.	Question	Mapping with CO	Mapping with PO	Mapping with PSO	Level of Learning
1	What are the different properties of random process? A wide sense stationary random process $X(t)$ is applied to the input of LTI system with impulse response $h(t) = 3e^{-2t} u(t)$ . Find the mean value of output $Y(t)$ of the system if $E[X(t)] = 2$ .	CO1	1	1	2
2	A random process is expressed as $X(t) = A \cos(\omega t + \Phi)$ where $\omega$ and $\Phi$ are constants and $A$ is a random variable. Determine whether $X(t)$ is wide sensed stationary (WSS) process.	CO1	2	1	2
2	If the random process $X(t)$ is real, then process that its power spectrum is real. Also verify that $S_{xx}(-\omega) = S_{xx}(\omega)$ .	CO1	2	1	2
3	The random process $X(t)$ is WSS. It is applied to an LTI system having an impulse response $4e^{-3t} u(t)$ . Find the mean value of output $Y(t)$ of the system if $E[X(t)] = 3$ .	CO1	2	1	2
4	Define random process. What is Time averages associated with random process?	CO1	2	1	1
5	Consider the random process $X(t) = A \cos(2\pi f_c t + \Phi)$ where $\Phi$ is a random variable uniformly distributed over $(-\pi, \pi)$ . Show that $X(t)$ is ergodic in both mean and autocorrelation.	CO1	2	1	2
6	Show that the random process $X(t) = A \cos(2\pi f_c t + \Phi)$ where $\Phi$ is a random variable uniformly distributed over $(0, 2\pi)$ is a wide sense stationary process.	CO1	2	1	2
7	If the random process is WSS then prove that $R_{xx}(-\tau) = R_{xx}(\tau)$ .	CO1	2	1	2
8	The random variable $X$ has a uniform distribution over a $0 \leq X \leq 2$ . Find the mean and mean square value for the random process $V(t) = 6e^{Xt}$ .	CO1	2	1	2
9	Derive an equation of PSD for ON-OFF signalling.	CO1	2	1	2
10	Explain narrowband noise and represent an narrowband noise in terms of inphase and quadrature components.	CO1	2	1	2

<b>11</b>	What is power spectral density? Derive the expression of PSD When a random process is transmitted through a LTI filter.	CO1	3	1	3
<b>12</b>	Classify and explain different types of random processes.	CO1	3	1	5
<b>13</b>	State any four properties of Power Spectral Density.	CO1	3	1	1
<b>14</b>	Define the following terms: Autocorrelation Function ii )Autocovariance Function	CO1	3	1	1
<b>15</b>	If a white Gaussian noise is passed through a ideal low pass filter find the autocorrelation function of the filtered noise. Assume passband amplitude response of filter $H(f) = 1$ and cutoff frequency $W$ Hz.	CO1	3	1	4

