


		Reg. No.:	
		Name :	
<div style="text-align: center;">  <div style="display: inline-block; vertical-align: middle;"> <h1 style="margin: 0;">VIT<sup>®</sup></h1> <p style="margin: 0;"><b>Vellore Institute of Technology</b></p> <p style="margin: 0; font-size: small;">(Deemed to be University under section 3 of UGC Act, 1956)</p> </div> </div>			
<b>Continuous Assessment Test II – March 2023</b>			
Programme	: <b>B.Tech (ECE)</b>	Semester	: <b>WS 2022-23</b>
Course	: <b>Random Processes</b>	Code	: <b>BECE207L</b>
		Class Nbr	: <b>CH2022235000473 CH2022235000475 CH2022235000477 CH2022235000480 CH2022235000482</b>
Faculty	: <b>Thiripurasundari D Ralph Samuel Thangaraj Chandrasekaran N Jeetashree Aparajeeta Kalaivanan K</b>	Slot	: <b>B1+TB1</b>
Time	: <b>90 Minutes</b>	Max. Marks	: <b>50</b>
<b>Answer <u>ALL</u> the questions</b>			
Q.No.	Sub. Sec.	Questions	Marks
1.		<p>Let <math>X = [X_1 \ X_2 \ X_3]^T</math> be a three dimensional zero mean Gaussian random vector with covariance matrix <math>C_X = \begin{bmatrix} 3 &amp; 3 &amp; 0 \\ 3 &amp; 5 &amp; 0 \\ 0 &amp; 0 &amp; 6 \end{bmatrix}</math>. If the new random vector Y is defined as</p> $Y_1 = 8X_1 - 3X_2 - X_3$ $Y_2 = -X_1 + 3X_2 - X_3$ $Y_3 = X_1 + X_3$ <p>Compute the mean and covariance matrix of Y.</p>	5
2.		<p>Let two random processes <math>A(t)</math> and <math>B(t)</math> be defined by</p> $A(t) = X \cos(\omega_0 t) + Y \sin(\omega_0 t)$ $B(t) = X \cos(\omega_0 t)$ <p>Where X and Y are random variable and <math>\omega_0</math> is a constant. <math>A(t)</math> is WSS if X and Y are uncorrelated zero mean random variables with the same variance. With these same constraints on X and Y, <math>B(t)</math> is also WSS.</p> <p>(i) Find the cross correlation function. (4 Marks)</p> <p>(ii) Show that <math>A(t)</math> and <math>B(t)</math> are jointly WSS. (2 Marks)</p> <p>(iii) Check whether <math>B(t)</math> is mean ergodic process or not? (4 Marks)</p>	10
3.		<p>Two statistically independent and zero-mean random processes <math>X(t)</math> and <math>Y(t)</math> have the following autocorrelation functions, respectively:</p> $R_{XX}(\tau) = e^{- \tau }$ $R_{YY}(\tau) = \cos(2\pi\tau)$ <p>Determine the following:</p>	10

		(i) the autocorrelation function of the process $U(t) = X(t) + Y(t)$ , (ii) the auto correlation function of the process $V(t) = X(t) - Y(t)$ , and (iii) the cross correlation function of $U(t)$ and $V(t)$ .	
4.		A random process $X(t)$ has a power spectral density given by $S_{XX}(w) = \begin{cases} \left(4 - \frac{W^2}{16}\right) &  w  \leq 4 \\ 0 & \text{otherwise} \end{cases}$ Find its auto correlation function and the average power.	10
5.	a	A stationary random process $X(t)$ has the auto correlation function $R_{XX}(\tau) = 8e^{-3 \tau }$ Find (i) The power spectral density (ii) The mean square value of the process.	5
	b	Suppose the discrete autocorrelation function of a random sequence is given by $R_{XX}[a] = \{25^{ a }, \text{ for } a = 0, \pm 1, \pm 2, \pm 3 \dots\}$ Compute its power spectral density.	5
6		A stationary process $X(t)$ is applied to the input of a system for which $h(t) = 3t^3 e^{(-8t)} u(t)$ If $E[X(t)] = 2$ , Find $\bar{Y}$ of the system's response.	5

Course Faculty

