

UNIT-III
Random process and temporal Characteristics

S.No	Questions	BT	CO	PO
Part – A (Short Answer Questions)				
1	Define random process.	Remember	CO3	PO1,PO2,PO4
2	Define ergodicity.	Remember	CO3	PO1,PO2,PO4
3	Define mean ergodic process.	Remember	CO3	PO1,PO2,PO4
4	State correlation ergodic process.	Remember	CO3	PO1,PO2,PO4
5	Explain the first order stationary process.	Understand	CO3	PO1,PO2,PO4
6	Discuss second order stationary process.	Understand	CO3	PO1,PO2,PO4
7	State wide sense stationary random process.	Remember	CO3	PO1,PO2,PO4
8	Define strict sense stationary random process.	Remember	CO3	PO1,PO2,PO4
9	Define auto correlation function of a random process.	Remember	CO3	PO1,PO2,PO4
10	Define cross correlation function of a random process.	Understand	CO3	PO1,PO2,PO4
Part – B (Long Answer Questions)				
11	a) Give classification of random processes and Write conditions for a wide sense stationary random process.	Understand	CO3	PO1,PO2,PO4
	b) Given $E[X(t)] = 6$ and $R_{xx}(t, t + \tau) = 36 + 25 \exp(-\tau)$ for a random process $X(t)$. Indicate which of the following statements are true based on what is known with certainty: $X(t)$ i. is first order stationary ii. has total average power of 61W iii. is ergodic iv. is wide sense stationary has a periodic component	Understand	CO3	PO1,PO2,PO4
	a) Show that the process $X(t) = A \cos(w_0 t + \theta)$ is wide sense stationary if it is assumed that A and w_0 are constants and θ is uniformly distributed random variable over the interval $(0, 2\pi)$.	Remember	CO3	PO1,PO2,PO4
	B If $X(t)$ is a stationary random process having a mean value $E[X(t)] = 3$ and auto correlation function $R_{xx}(\tau) = 9 + 2e^{-\tau}$ Find i. The mean value and ii. The variance of the random variable of $R_{xx}(\tau) = \int_0^2 x(t) dt$	Understand	CO3	PO1,PO2,PO4
13	a) Show that the process $X(t) = A \cos(w_0 t + \theta)$ is wide sense stationary if it is assumed that A and w_0 are constants and θ is uniformly distributed random variable over the interval $(0, 2\pi)$.	Remember	CO3	PO1,PO2,PO4
	b) Assume that an ergodic random process $X(t)$ has an auto correlation $R_{xx}(\tau) = 18 + \frac{2}{6 + \tau^2} (1 + 4 \cos(2\tau))$ find mean X i) Does the process have a periodic component.	Understand	CO3	PO1,PO2,PO4
14	a) State and prove any four properties of cross correlation function and cross covariance function.	Remember	CO3	PO1,PO2,PO4

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	b)	Explain and prove any four properties of auto correlation function and auto covariance function.	Understand	CO3	PO1,PO2,PO4
15	a)	A random process is defined as $X(t) = A \cos(\omega_c t + \theta)$ where θ is a uniform random variable over $(0, 2\pi)$. Verify the process is ergodic in the mean sense and auto correlation sense.	Remember	CO3	PO1,PO2,PO4
	b)	Define a random process by $X(t) = A \cos(t)$, where A is a Gaussian Random Variable with zero mean variance σ^2 i. Find the density function of $X(0)$ and $X(1)$ ii. Is $X(t)$ stationary in any sense	Remember	CO3	PO1,PO2,PO4
16	a)	Consider two random processes $X(t) = A \cos(\omega_1 t + \theta)$ and $Y(t) = B \cos(\omega_2 t + \Phi)$ where a, b, ω_1, ω_2 are constants, while θ, Φ are statistically independent random variables uniformly distributed on $(0, 2\pi)$ A) ST $X(t)$ and $Y(t)$ are jointly WSS B) If $\theta = \Phi$ show that $x(t)$ and $y(t)$ are not jointly wss unless $\omega_1 = \omega_2$	Understand	CO3	PO1,PO2,PO4
	b)	Find mean, variance and average power for a stationary ergodic random processes has the $R_{xx}(\tau) = 25 + \frac{4}{6 + \tau^2}$ auto correlation function with the periodic Component	Understand	CO3	PO1,PO2,PO4

