

**VIT**Vellore Institute of Technology
Chennai

Reg. Number:

23BEC1091

Continuous Assessment Test (CAT) – II - MAR 2025

Programme	: B.Tech (ECE)	Semester	: WS 2024-25
Course Code & Course Title	: BECE207L Random Processes	Slot	: D1+TD1
Faculty	: Dr. Kalaivanan K Dr. Mohammed Aarif K.O. Dr. Thiripurasundari D	Class Number	: CH2024250501182 CH2024250501185 CH2024250501178
Duration	: 90 Min	Max. Mark	: 50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks	Blooms Taxonomy Level
1.	(a)	A book contains 500 pages and contains, on average, one misprint every ten pages. Estimate the probability that a random selection of five pages will contain two misprints. Does it matter whether the five pages are contiguous? [5 marks]	[10]	L3
	(b)	Suppose the cross-power spectrum is defined by; $\ell_{XY}(\omega) = \begin{cases} c + d \sin\left(\frac{\pi\omega}{W}\right), & -W < \omega < W \\ 0, & \text{Elsewhere} \end{cases}$ where $W > 0$ and c, d are real constants. Find the cross-correlation function. [5 marks]		
2.		Given a random process $X(t) = \cos(\omega t + \theta)$ where θ is uniformly distributed in the interval $(-\pi, \pi)$. Verify whether $X(t)$ is WSS and correlation ergodic. For what value of 't' the random process $X(t)$ is uncorrelated.	[10]	L3
3.		A Gaussian random process has an autocorrelation function $R_{XX}(\tau) = 8 \exp\left(-\frac{ \tau }{3}\right)$ (i) Determine the covariance matrix of the random variables: $X(t), X(t+1), X(t+2), X(t+3), X(t+4)$. [6 marks] (ii) Compute the correlation coefficient between $X(t)$ and $X(t+4)$. [4 marks]	[10]	L3
4.		Given the power spectral density $S_{XX}(\omega) = \frac{1}{4+\omega^2}$, find the autocorrelation function and hence the average power of the		

	(b)	process $X(t)$. [5 marks] Find the power of random process $X(t) = A \sin(\omega_0 t + \theta)$ in time domain analysis, where A and ω_0 is a constant, θ is uniformly distributed random variable in the range of $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$. [5 marks]	[10]	L4
5.		Let the Cross-correlation function of two processes $X(t)$ and $Y(t)$ be $R_{XY}(t, t + \tau) = \frac{AB}{2} \{ \sin(\omega_0 \tau) + \cos[\omega_0(2t + \tau)] \} + \frac{C}{2} e^{-\alpha \tau }$ where A, B and ω_0 are constants. Find the cross-power spectrum.	[10]	L4

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