

**VIT**

Vellore Institute of Technology

REG.NO.:

23BML0012

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025

SLOT: A2+TA2

Programme Name & Branch : B. Tech - ECE
 Course Code and Course Name : BECE207L - Random Processes
 Faculty Name(s) : Dr. VALARMATHI J, Dr. ASHISH P, Dr. HARIHARAN S.
 Class Number(s) : 0633, 0644, 0648
 Date of Examination : 16-03-2025
 Exam Duration : 90 minutes

Maximum Marks: 50

Answer All Questions

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

- CO3: Interpret the random processes in terms of stationarity, statistical independence, and correlation.
- CO4: Compute the power spectral density of the random signals.
- CO5: Interpret the effect of random signals on LTI systems output both in the time and frequency domain.

Q. No	Question	M	CO	BL
1.	The autocorrelation function of WSS ergodic process is given by $R_{XX}(\tau) = \frac{4\tau^2 + 100}{\tau^2 + 4}$. Find the mean, mean square and variance of the random process $X(t)$.	10	3	3
2.	If the random process, $X(t) = A \cos(t) + (B + 1)\sin(t)$ where A and B are independent random variables with mean zero and mean squared value equals to one. Find the mean, autocorrelation, and autocovariance function of $X(t)$. Is $X(t)$ WSS?	10	3	3
3.	A zero-mean WSS random process $X(t)$, $-\infty < t < \infty$, has the following power spectral density $S_{XX}(\omega) = \frac{4}{1 + \omega^2}$ $-\infty < \omega < \infty$. i. Find the autocorrelation of $X(t)$. ii. Find the mean and variance of $Y(t)$ which is defined by $Y(t) = \sum_{k=0}^1 X(t + k)$.	10	4	3
4.	Consider a random process $x[n] = A \cos(n\omega_0 + \phi)$. For the following cases, find the autocorrelation sequence and if the process is WSS, find the power spectrum. i. ϕ is uniformly distributed over the interval $(-\pi, \pi)$, A and ω_0 are constants. ii. ϕ and ω_0 are random and uniformly distributed over the interval $[-\pi, \pi]$ and $[\omega_0 - \Delta, \omega_0 + \Delta]$ respectively and A is constant.	10	4	3
5.	If the autocorrelation of a stationary process $X(t)$ is given by, $R_{XX}(\tau) = \cos(5\tau) + \cos(10\tau) + \cos(20\tau)$, i. Find the power spectral density of $X(t)$. ii. If $X(t)$ is given as an input to a system with transfer function $H(\omega) = \text{sinc}\left(\frac{\omega}{10}\right)$, find the power spectral density and autocorrelation of the output process.	10	5	3