

**VIT**Vellore Institute of Technology
(Approved by the Council for Higher Education, India, under the UGC Act, 1956)

School of Electronics Engineering
Winter Semester (2023-2024)
Continuous assessment test - I
BECE207L - Random Processes

Date: 15-FEB-2024

SLOT: E2+TE21

Marks: 50

Duration: 90 Min

Note: Use of standard Normal Gaussian distribution table is permitted.

Q. No	Answer All Questions	Marks	CO	BL
1.	Given the function $f_{X,Y}(x,y) = \begin{cases} b(x+y)^2 & -2 < x < 2 \text{ and } -3 < y < 3 \\ 0 & \text{elsewhere} \end{cases}$ (a). Find the constant b such that this is a valid joint density function. (b). Determine the marginal density functions $f_X(x)$ and $f_Y(y)$.	10	CO1	L3
2.	If X and y are two independent random variables and both have exponential distributions as $f_X(x) = ae^{(-ax)}u(x)$, $f_Y(y) = be^{(-by)}u(y)$ $a, b > 0$ Find $f_Z(z)$ when $Z = X + Y$.	10	CO1	L3
3.	The random variable $Y = X_1 + X_2 + \dots + X_{48}$, where X_i are independent and uniformly distributed random variables over $[1,4]$. Find the probability $P(108 \leq Y \leq 126)$ using central limit theorem.	10	CO1	L3
4.	Random variables X_1 and X_2 have the joint characteristic function $\phi_{X_1, X_2}(\omega_1, \omega_2) = [(1 - j2\omega_1)(1 - j2\omega_2)]^{-N/2}$ where $N > 0$ is an integer. (a) Find the correlation and moments m_{20} and m_{02} . (b) Determine the means of X_1 and X_2 . (c) What is the correlation coefficient?	10	CO2	L3
5.	The joint PDF of X and Y is given by $f_{X,Y}(x,y) = e^{-(x+y)}$; $x \geq 0, y \geq 0$. Determine the joint density of U and V , where $U = \frac{X+Y}{2}$ and $V = Y$. Also check whether U and V are independent.	10	CO2	L3

