



VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1978)

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

SLOT: A1+TA1

Programme Name & Branch	: B. Tech - ECE	
Course Code and Course Name	: BECE207L - Random Processes	
Faculty Name(s)	: Dr. RAMACHANDRA REDDY, Dr. MALAYA KUMAR HOTA Dr. HARIHARAN S, Dr. ASHISH P, Dr. MUGELAN R K	
Class Number(s)	: 0631, 0642, 0646, 4700, 0654	
Date of Examination	: 27-01-2025	
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)

- **CO1:** Compute the probability density functions for multiple random variables.
- **CO2:** Perform transformation on multiple random variables and complex random variables.

Q. No	Question	M	CO	BL																												
1.	If the joint distribution function of the random variables X and Y is $F_{X,Y}(x,y) = u(x)u(y)[1 - e^{-ax} - e^{-ay} + e^{-a(x+y)}]$ - Find the joint density function and marginal density function of X and Y. - Find the conditional density functions $f_X(x Y = y)$ and $f_Y(y X = x)$ - Are the random variables X and Y statistically independent?	10	1	3																												
2.	Two random variables X and Y are independent and have probability mass function as $P_X(x) = \delta(x) - 2\delta(x - 1) + \delta(x - 3)$ and $P_Y(y) = u(y) - u(y - 3)$. A new random variable Z is obtained as $Z = X + Y$. Find the probability mass function of Z .	10	1	3																												
3.	Let the joint PDF of X and Y is $f_{X,Y}(x,y) = \begin{cases} 2e^{-(x+y)}; & 0 < x < y \leq \infty \\ 0; & \text{Otherwise} \end{cases}$ - Locate the region of the function $f_{X,Y}(x,y)$ in (X, Y) plane. - If $Z = X + Y$ and $W = \frac{Y}{X}$, determine the joint PDF of Z and W. - Check whether Z and W are independent random variables.	10	2	3																												
4.	The joint probability mass function of X and Y is given by, <table border="1"><tr><th>x \ y</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr><tr><th>0</th><td>0</td><td>0</td><td>1/32</td><td>1/16</td><td>1/16</td><td>3/32</td></tr><tr><th>1</th><td>1/16</td><td>1/16</td><td>1/8</td><td>1/8</td><td>1/8</td><td>1/8</td></tr><tr><th>2</th><td>1/32</td><td>1/32</td><td>1/64</td><td>1/64</td><td>0</td><td>1/32</td></tr></table> Find the covariance, $P[Y \leq 3 / X \leq 1]$ and $P[X + Y \leq 4]$.	x \ y	1	2	3	4	5	6	0	0	0	1/32	1/16	1/16	3/32	1	1/16	1/16	1/8	1/8	1/8	1/8	2	1/32	1/32	1/64	1/64	0	1/32	10	2	3
x \ y	1	2	3	4	5	6																										
0	0	0	1/32	1/16	1/16	3/32																										
1	1/16	1/16	1/8	1/8	1/8	1/8																										
2	1/32	1/32	1/64	1/64	0	1/32																										
5.	Two random variables X and Y have the joint characteristic function, $\phi_{X,Y}(\omega_1, \omega_2) = \exp(-3\omega_1^2 - 10j\omega_1 - 9\omega_2^2 - 20j\omega_2)$ - Find the moments m_{10}, m_{01}, m_{11} and the covariance. - Check whether X and Y are independent.	10	2	3																												