REG.NO.: 24BEC0174

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2025-2026

SLOT: A1+TA1

Programme Name & Branch : B.Tech (ECE)

Course Code and Course Name : BECE207L - Random processes

Faculty Name(s) : Dr. CHRISTOPHER CLEMENT J; Dr. KALAIVANI S; Dr. MALAYA KUMAR HOTA; Dr. HARIHARAN S; Dr. ASHISH P; Dr. HEMANTA KUMAR SAHU

Class Number(s) : VL2025260500727, 0738, 0730, 0734, 0723, 0744

Date of Examination : 27- JAN - 2026

Exam Duration : 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes

  CO-1: Compute the moments using probability density functions of multiple random variables.

  CO-2: Compute the probability density functions of multiple random variables using transformation techniques.

<table>
<tr><th>Q. No</th><th>Question</th><th>M</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>Given the pdf $f(x) = \frac{1}{2}\, e^{-|x|}$, find the Moment Generating Function of X. Using the MGF, find the mean and variance of X.</td><td>10</td><td>1</td><td>3</td></tr>
<tr><td>2.</td><td>If the joint density function of two random variables X and Y is

$$f_{X,Y}(x,y) = 3x\, e^{-x(y+3)}\,; \qquad x \geq 0 \text{ and } y \geq 0$$

Determine the marginal density functions $f_X(x)$ and $f_Y(y)$, the conditional density functions $f_X(x|Y=y)$.

Find the range of X, for which the conditional density is a valid density function?

Are the random variables statistically independent?</td><td>10</td><td>1</td><td>3</td></tr>
<tr><td>3.</td><td>Let X and Y be two discrete random variables with probability mass function as

<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>$p_X(x)$</td><td>0.1</td><td>0.3</td><td>0.2</td><td>0.4</td></tr>
</table>

<table>
<tr><td>Y</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>$p_Y(y)$</td><td>0.4</td><td>0.2</td><td>0.2</td><td>0.2</td></tr>
</table>

Define a new random variable $Z = X + Y$

Find the probability mass function of Z, If X and Y are statistically independent</td><td>10</td><td>1</td><td>3</td></tr>
</table>

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4.	The joint CDF of X and Y is given by $F_{XY}(x, y) = (1 - e^{-x})(1 - e^{-y}); 0 < x < \infty$ and $0 < y < \infty$. Find the joint density function of U and V, if $U = \frac{X+Y}{2}$ and V=Y	10	2	3
5.	Two random variables X and Y have means 1 and 2, respectively, and variances 4 and 1, respectively. Their correlation coefficient is 0.4. New random variables W and V are defined as $V = -X + 2Y; W = X + 3Y$. Find (a) means (b) variances and (c) correlation coefficient of V and W.	10	2	3

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