



Continuous Assessment Test (CAT) – I - JAN 2025

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

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks	Blooms Taxonomy Level
1.		Two random variables X and Y have the following Joint PDF $f_{XY}(x, y) = \begin{cases} ke^{-(4y+6x)} & 0 \leq x \leq \infty, 0 \leq y \leq \infty \\ 0 & \text{otherwise} \end{cases}$ (i) Determine the conditional density functions $f_X(x/Y=y)$ and $f_Y(y/X=x)$. [8 marks] (ii) Find the constant k. [2 marks] 24	10	L3
2.		The joint distribution function for two random variables X and Y is $F_{X,Y}(x, y) = u(x)u(y)(1 - e^{-2x})(1 - e^{-2y})$ Find the probabilities (i) $P\{X \leq 1, Y \leq 2\}$ [3 marks] (ii) $P\{0.5 < X < 1.5\}$ [3 marks] (iii) $P\{1 < X \leq 2, 1 < Y \leq 3\}$ [4 marks]	10	L3
3.		The joint distribution function for two random variables X and Y is $F_{X,Y}(x, y) = u(x)u(y)[1 - e^{-ax} - e^{-ay} + e^{-a(x+y)}]$ (i) Find the PDF $f_{XY}(x, y)$. [3 marks] (ii) Determine the marginal density functions $f_X(x)$ and $f_Y(y)$. [3 marks] (iii) Find the marginal distribution functions $F_X(x)$ and $F_Y(y)$. [3 marks] (iv) Are X and Y statistically independent? [1 marks] 44	10	L3

4. 	For two random variables X and Y, and the density function is $f_{X,Y}(x,y) = u(x)u(y)e^{-3(x+y)}$ (i) Determine the mean of X and Y. [2 marks] (ii) Determine the covariance of X and Y. [4 marks] (iii) Determine the correlation co-efficient of X and Y. [2 marks] (iv) Are X and Y uncorrelated? [1 marks] No (v) Are X and Y orthogonal? [1 marks] No	10	L4
5.	Let $X = [X_1 \ X_2 \ X_3]^T$ be a three dimensional zero mean Gaussian random vector with covariance matrix $C_X = \begin{bmatrix} 3 & 3 & 0 \\ 3 & 5 & 0 \\ 0 & 0 & 6 \end{bmatrix}$ If the new random vector Y is defined as $Y_1 = 8X_1 - 3X_2 - X_3$ $Y_2 = -X_1 + 3X_2 - X_3$ $Y_3 = X_1 + X_3,$ Compute the mean and covariance matrix of Y.	10	L4

*****All the best *****