

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.	Discrete random variables X and Y have a joint density function $f_{X,Y}(x,y) = 0.10\delta(x+4)\delta(y-1) + 0.15\delta(x+3)\delta(y+5)$ $+ 0.17\delta(x+1)\delta(y-3) + 0.05\delta(x)\delta(y-1)$ $+ 0.18\delta(x-2)\delta(y+2) + 0.23\delta(x-3)\delta(y-4)$ $+ 0.12\delta(x-4)\delta(y+3)$ (a) Determine the joint distribution function $F_{X,Y}(x,y)$ (b) Find Marginal distribution functions $F_X(x)$ and $F_Y(y)$ (c) Find $E[X]$ and $E[Y]$.	10	1	3
2.	Two random variables X and Y are independent and both have exponential distributions with $f_X(x) = 2e^{-2x}u(x)$ and $f_Y(y) = 3e^{-3y}u(y)$. A new random variable Z is obtained as $Z = X + Y$. Find the probability density function of Z.	10	1	3
3.	Find the correlation coefficient of the two random variables X and Y having the joint PDF, $f_{X,Y}(x,y) = \begin{cases} \frac{3}{2}(x^2 + y^2); & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0; & \text{Otherwise} \end{cases}$	10	2	3
4.	Let the joint PDF of X and Y is $f_{X,Y}(x,y) = \begin{cases} e^{-x}; & 0 < y < x \leq \infty \\ 0; & \text{Otherwise} \end{cases}$ i. Locate the region of the function $f_{X,Y}(x,y)$ in (X, Y) plane. ii. If $U = X + Y$ and $V = X - Y$, determine the joint PDF of U and V. iii. Check whether U and V are independent random variable.	10	2	3
5.	The joint Moment Generating Function of two random variables X and Y is given by $M_{XY}(s_1, s_2) = e^{\{-2s_1^2 + 7s_1 - 6s_2^2 + 3s_2\}}$ i. Find the mean of X, Y and the correlation $E[XY]$. ii. Are X and Y uncorrelated?	10	2	3