MA8402 – PROBABILITY AND QUEUEING THEORY

(REGULATION 2017)

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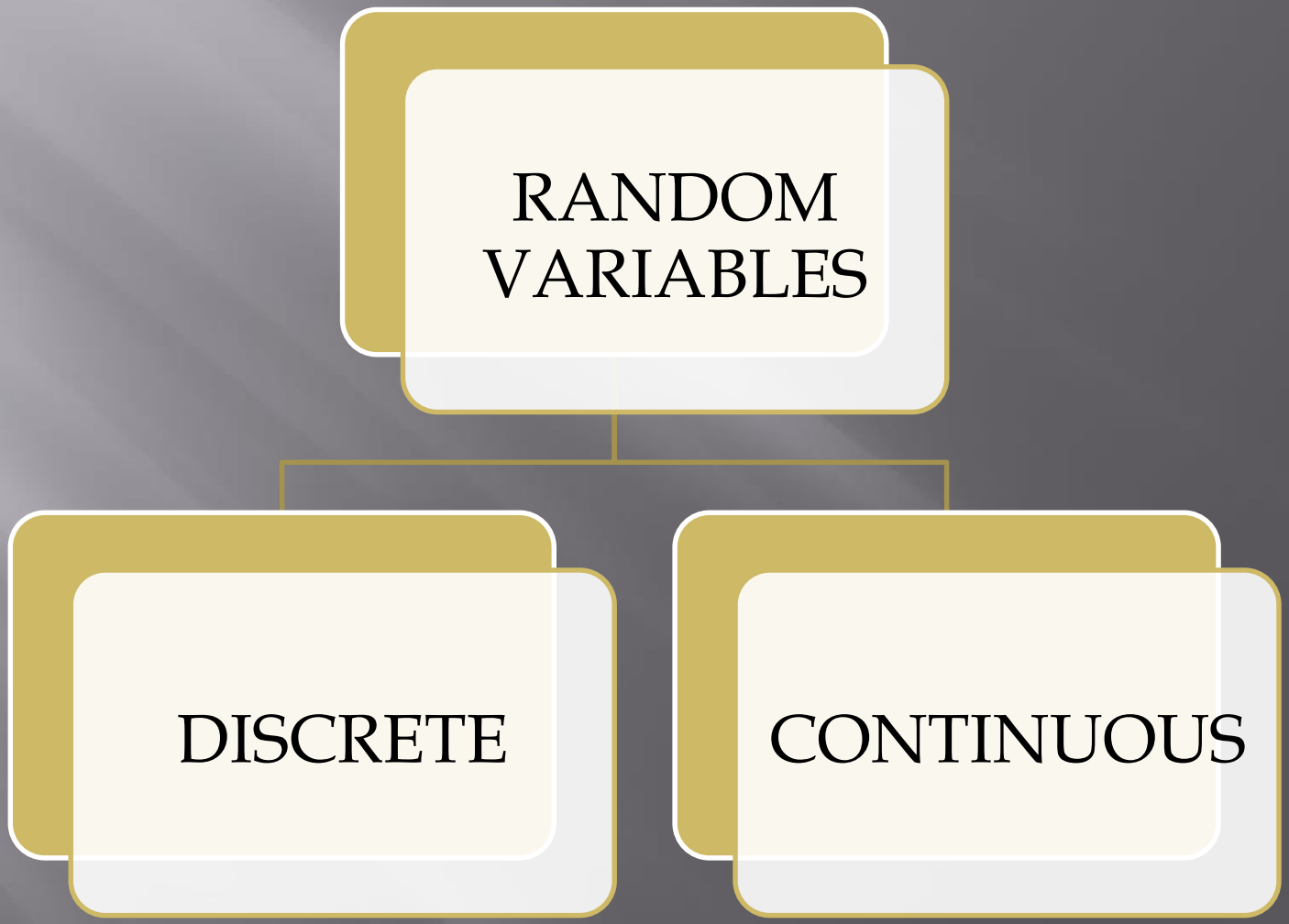
UNIT-2
TWO DIMENSIONAL RANDOM VARIABLES

- Many situations of our Engineering problems are handled by the theory of two random variables.
- Hence such important concepts as auto correlation, cross – correlation and co-variance functions, which apply to random processes , are based on two random variables

RANDOM VARIABLES



Marginal Probability Function of X

- If the joint probability distribution of two random variables X and Y is given then the marginal probability function of X is given by
- $P_x(x_i) = p_i$ (marginal probability function of Y)
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- **Conditional Probabilities**
- The conditional probabilities function of X given $Y = y_j$ is given by P(X/Y)

Example 1

From the following joint distribution of X and Y find the marginal distributions.

X / Y	0	1	2
0	3/28	9/28	3/28
1	3/14	3/14	0
2	1/28	0	0

Solution

Solution

X / Y	0	2	$P_Y(y) = p(Y=y)$
0	3/28 P(0,0)	3/28 P(2,0)	15/28 = $P_y(0)$
1	3/14 P(0, 1)	3/14 P(1,1)	6/14 = $P_y(1)$
2	1/28 P(0,2)	0 P(2,2)	1/28 = $P_y(2)$
$P_X(X) = P(X=x)$	10/28 = 5/14 $P_X(0)$	3/28 $P_X(2)$	1

The marginal distribution of X

$$P_X(0) = P(X = 0) = p(0,0) + p(0,1) + p(0,2) = 5/14$$
$$P_X(1) = P(X = 1) = p(1,0) + p(1,1) + p(1,2) = 15/28$$
$$P_X(2) = P(X = 2) = p(2,0) + p(2,1) + p(2,2) = 3/28$$

The marginal distribution of X

$$P_X(0) = P(X=0) = p(0,0) + p(0,1) + p(0,2) = 5/14$$
$$P_X(1) = P(X=1) = p(1,0) + p(1,1) + p(1,2) = 15/28$$
$$P_X(2) = P(X=2) = p(2,0) + p(2,1) + p(2,2) = 3/28$$

Marginal probability function of X is

$$P_X(x) = \begin{cases} \frac{5}{14}, & x = 0 \\ \frac{15}{28}, & x = 1 \\ \frac{3}{28}, & x = 2 \end{cases}$$

The marginal distribution of Y

$$P_Y(0) = P(Y=0) = p(0,0) + p(1,0) + p(2,0) = 15/28$$
$$P_Y(1) = P(Y=1) = p(0,1) + p(2,1) + p(1,1) = 3/7$$

$$P_Y(2) = P(Y=2) = p(0,2) + p(1,2) + p(2,2) = 1/28$$

Marginal probability function of Y is

$$P_Y(y) = \begin{cases} \frac{15}{28}, & y=0 \\ \frac{3}{7}, & y=1 \\ \frac{1}{28}, & y=2 \end{cases}$$

THANK YOU