



## UNIT 2- Orthogonal Transformation of a Real Symmetric Matrix

## Quadratic Form

Quadratic form (Q) Period: 2

A homogeneous polynomial of degree 2 in any number of variables is called quadratic form.

NOTE :-

The matrix corresponding to the quadratic form is

$$A = \begin{pmatrix} \text{coeff of } x_1^2 & \frac{1}{2} \text{ coeff of } x_1 x_2 & \frac{1}{2} \text{ coeff of } x_1 x_3 \\ \frac{1}{2} \text{ coeff of } x_2 x_1 & \text{coeff of } x_2^2 & \frac{1}{2} \text{ coeff of } x_2 x_3 \\ \frac{1}{2} \text{ coeff of } x_3 x_1 & \frac{1}{2} \text{ coeff of } x_3 x_2 & \text{coeff of } x_3^2 \end{pmatrix}$$

(Note: The off-diagonal elements are half the coefficient of the corresponding cross terms, and the diagonal elements are the coefficients of the squared terms.)

Write the matrix form of quadratic form

i)  $2x_1^2 - 2x_2^2 + 4x_3^2 + 2x_1x_2 - 6x_1x_3 + 6x_2x_3$

ii)  $2x^2 + 8z^2 + 4xy + 10xz - 2yz$



Write the quadratic form of matrix.

i) 
$$\begin{pmatrix} 0 & -10 & 2 \\ -1 & 1 & 4 \\ 2 & 4 & 3 \end{pmatrix} = 0$$

$x_2^2 + 3x_3^2 - 2x_1x_2 + 4x_1x_3 + 8x_2x_3$

ii) 
$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 4 \end{pmatrix}$$

$x_1^2 - x_2^2 + 4x_3^2$