Matrix

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Conjugate Matrix - If we replace each element of given matrix A by its complex conjugate, then the new matrix obtained is called conjugate matrix of A and is denoted by $\bar{A}$

Eg. Let $A = \begin{bmatrix} 2+i & 3-4i & 5 \\ 8+3i & -2i & 4-5i \end{bmatrix}$

then the new matrix obtained is called Conjugate matrix of A and that is equal to

$$\bar{A} = \begin{bmatrix} 2-i & 3+4i & 5 \\ 8-3i & +2i & 4+5i \end{bmatrix}$$

Tranjugate Matrix.

The transpose of a Conjugate matrix A is called tranjugate matrix and is denoted by A^{θ} i.e.

$$A^{\theta} = (\bar{A})'$$

eg. Let $A = \begin{bmatrix} 4+5i & 3-4i & 2 \\ 5+6i & 0 & 7+3i \\ 5-4i & 6+9i & 7+8i \end{bmatrix}$

$\bar{A} = \begin{bmatrix} 4-5i & 3+4i & 2 \\ 5-6i & 0 & 7-3i \\ 5+4i & 6-9i & 7-8i \end{bmatrix}$

$A^{\theta} = (\bar{A})' = \begin{bmatrix} 4-5i & 5-6i & 5+4i \\ 3+4i & 0 & 6-9i \\ 2 & 7-3i & 7-8i \end{bmatrix}$

Hermitian Matrix- A Square matrix A is Called Hermitian matrix if $A = (\bar{A})'$ i.e if every i-jth element of A is equal to complex conjugate j-ith element of A $\Rightarrow a_{ij} = \bar{a}_{ji}$

Note Every diagonal element of Hermitian matrix is real.

eg. $\begin{bmatrix} a & c-id \\ c+id & b \end{bmatrix}$

$\begin{bmatrix} 1 & 1-i & 2 \\ 1+i & 3 & i \\ 2 & -i & 0 \end{bmatrix}$ are Hermitian Matrix.

Skew Hermitian Matrix :- A square matrix A is called skew-Hermitian matrix, if $A = -(\bar{A})'$ i.e. if every $i-j$ th element of A is equal to negative of Complex conjugate of $j-i$ th elements of $A \Rightarrow a_{ij} = -a_{ji}$.

Note - Diagonal elements of a skew Hermitian matrix are either purely imaginary or zero.