

# Assignment-8

B.SandhyaRani

Download all python codes from

<https://github.com/balumurisandhyarani/Assignment8/tree/main/Assignment8>

therefore

$$\mathbf{B}^T \mathbf{A} \mathbf{B} \quad (2.0.15)$$

and latex-tikz codes from

<https://github.com/balumurisandhyarani550/Assignment8/tree/main/Assignment8>

is skew symmetric.

## 1 QUESTION No-2.42

Show that the matrix  $\mathbf{B}^T \mathbf{A} \mathbf{B}$  is symmetric or skew symmetric according as  $\mathbf{A}$  is symmetric or skew symmetric.

## 2 SOLUTION

If  $\mathbf{A}$  be symmetric i.e.,

$$\mathbf{A}^T = \mathbf{A} \quad (2.0.1)$$

then

$$(\mathbf{B}^T \mathbf{A} \mathbf{B})^T = [\mathbf{B}^T (\mathbf{A} \mathbf{B})]^T \quad (2.0.2)$$

$$(\mathbf{A} \mathbf{B})^T (\mathbf{B}^T)^T \quad (2.0.3)$$

$$= (\mathbf{B}^T \mathbf{A}^T) \mathbf{B} \quad (2.0.4)$$

$$= \mathbf{B}^T \mathbf{A}^T \mathbf{B} \quad (2.0.5)$$

$$= \mathbf{B}^T \mathbf{A} \mathbf{B} \quad (2.0.6)$$

$$(2.0.7)$$

Hence

$$\mathbf{B}^T \mathbf{A} \mathbf{B} \quad (2.0.8)$$

is symmetric.

If  $\mathbf{A}$  is skew symmetric i. e.,

$$\mathbf{A}^T = -\mathbf{A} \quad (2.0.9)$$

then

$$(\mathbf{B}^T \mathbf{A} \mathbf{B})^T = [\mathbf{B}^T (\mathbf{A} \mathbf{B})]^T \quad (2.0.10)$$

$$= (\mathbf{A} \mathbf{B})^T (\mathbf{B}^T)^T \quad (2.0.11)$$

$$= (\mathbf{B}^T \mathbf{A}^T) \mathbf{B} \quad (2.0.12)$$

$$= \mathbf{B}^T (-\mathbf{A}) \mathbf{B} \quad (2.0.13)$$

$$= -(\mathbf{B}^T \mathbf{A} \mathbf{B}) \quad (2.0.14)$$