Assignment 2

D V K M Rishab
AI20MTECH14004

Download the python code, latex file and the pdf doc from

https://github.com/Rishab9991/EE5609/tree/master/Assignments/Assignment2

1) **Solution:**

$$A = \begin{pmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{pmatrix} \tag{1}$$

$$\implies A^T = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix} \tag{2}$$

$$\begin{pmatrix} a_1 \\ a_2 \end{pmatrix} = \begin{pmatrix} a_1 & -a_2 \\ a_2 & a_1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \tag{3}$$

$$i.e\ A = \begin{pmatrix} \cos\alpha \\ -\sin\alpha \end{pmatrix} \tag{4}$$

$$A^T = \begin{pmatrix} \cos\alpha \\ \sin\alpha \end{pmatrix} \tag{5}$$

$$\implies A^T A = \begin{pmatrix} \frac{e^{j\alpha}+e^{-j\alpha}}{2} \\ \frac{e^{j\alpha}-e^{-j\alpha}}{2j} \end{pmatrix} \begin{pmatrix} \frac{e^{j\alpha}+e^{-j\alpha}}{2} \\ -\frac{e^{j\alpha}-e^{-j\alpha}}{2j} \end{pmatrix} \tag{6}$$

$$\implies A^T A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \tag{7}$$

$$\implies A^T A = I \tag{8}$$

2) **Solution:**

$$A = \begin{pmatrix} \sin\alpha & \cos\alpha \\ -\cos\alpha & \sin\alpha \end{pmatrix} \tag{9}$$

$$\implies A^T = \begin{pmatrix} \sin\alpha & -\cos\alpha \\ \cos\alpha & \sin\alpha \end{pmatrix} \tag{10}$$

Using (3),

$$i.e\ A = \begin{pmatrix} \sin\alpha \\ -\cos\alpha \end{pmatrix} \tag{11}$$

$$A^T = \begin{pmatrix} \sin\alpha \\ \cos\alpha \end{pmatrix} \tag{12}$$

$$\implies A^T A = \begin{pmatrix} \frac{e^{j\alpha}-e^{-j\alpha}}{2j} \\ \frac{e^{j\alpha}+e^{-j\alpha}}{2} \end{pmatrix} \begin{pmatrix} \frac{e^{j\alpha}-e^{-j\alpha}}{2j} \\ -\frac{e^{j\alpha}+e^{-j\alpha}}{2} \end{pmatrix} \tag{13}$$

$$\implies A^T A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \tag{14}$$

$$\implies A^T A = I \tag{15}$$

Hence proved for both Problems 1 and 2.