Oppenheim Assignment 1

EP20BTECH11020

Q. Determine the inverse Z-transform of:

$$X(z) = \sin(z) \quad \text{ROC includes } |z| = 1 \tag{1}$$

Solution:

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ... \tag{2}$$

$$\implies X(z) = z - \frac{z^3}{3!} + \frac{z^5}{5!} - \frac{z^7}{7!} + ... \tag{3}$$

$$X(e^{\jmath\omega}) = e^{\jmath\omega} - \frac{e^{\jmath 3\omega}}{3!} + \frac{e^{\jmath 5\omega}}{5!} - \frac{e^{\jmath 7\omega}}{7!} + ... \tag{4}$$

We know that:$x(n) = \frac{1}{2\pi}\int_{-\pi}^{\pi} H(e^{\jmath\omega})e^{\jmath\omega n}d\omega$ (5)

$$x(n) = \{..., \frac{-1}{7!}, 0, \frac{1}{5!}, 0, \frac{-1}{3!}, 0, 1, \underset{\uparrow}{0}, 0, 0, ...\} \tag{6}$$