Gate 2023 EE Q36

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Gate 2023 EE Q36 The magnitude and phase plots of an LTI systems are shown in figure. Find the transfer function.
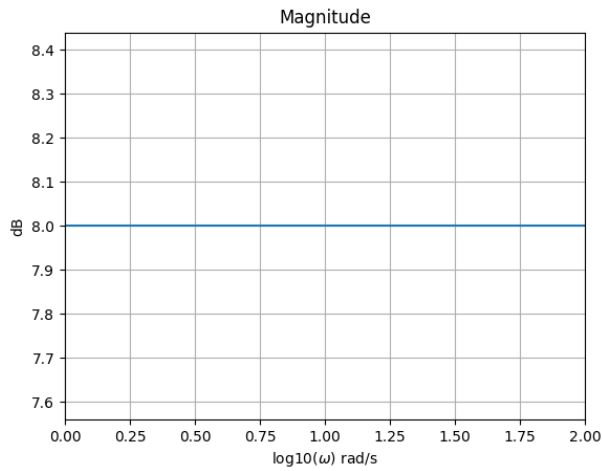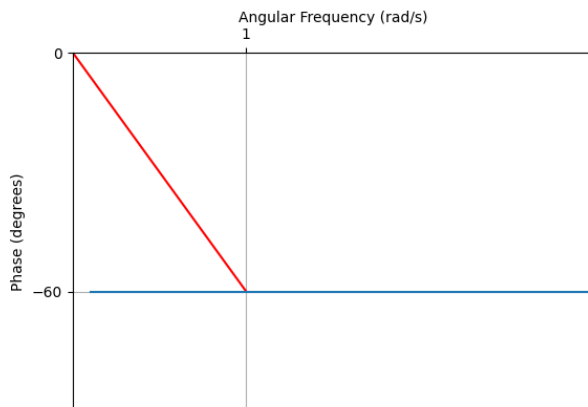

Fig. 0. Magnitude

Fig. 0. Phase

with ω.

$$|H(j\omega)|\,,(dB) = 20\log_{10}(|H(j\omega)|) \quad (1)$$

$$8 = 20\log_{10}(|H(j\omega)|) \quad (2)$$

$$|H(j\omega)| = 10^{0.4} = 2.511 \quad (3)$$

From the graph 0, we can infer the relation between phase and ω:

$$\text{phase} = \frac{-\pi}{3}\omega \quad (4)$$

The direction of the transfer function is:

$$e^{-j\frac{\pi}{3}\omega} \quad (5)$$

The transfer function is a product of its magnitude and direction,

$$H(j\omega) = |H(j\omega)|\,\angle H(j\omega) \quad (6)$$

$$H(j\omega) = 2.511e^{-j\frac{\pi}{3}\omega} \quad (7)$$

$$= 2.511e^{-0.032s} \quad (8)$$

Solution: From the graph 0, we can infer that the magnitude of the transfer function does not change