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IS/ENG04/050

Electrical/Electronics Eng.

Assignment Solution

Determine the type of filter shown below and show that frequency is $\omega_c = \frac{1}{RC}$



$$Z_C = \frac{1}{j\omega C} \quad V = \frac{1}{j\omega C} = I_i$$

$$V = \left[R + \frac{1}{j\omega C} \right] I_i \quad H(\omega) = \frac{V_o}{V_i} = \frac{\left[\frac{1}{j\omega C} \right] I_i}{\left[R + \frac{1}{j\omega C} \right] I_i}$$

$$= \frac{1}{\left[R + \frac{1}{j\omega C} \right]} = \frac{1}{j\omega RC + 1}$$

when $\omega = 0$; $H = 1$ when $\omega = \infty$; $H = 0$

ω_c is obtained by $H(\omega) = \frac{1}{\sqrt{2}}$ which implies

$$H(\omega) = \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{j\omega RC + 1}}$$

$$2 = (j\omega RC)^2 + 1$$

$$2 - 1 = \omega^2 R^2 C^2 + 1 = 1$$

$$\sqrt{1} = \sqrt{\omega^2 R^2 C^2}$$

$$\omega = \frac{1}{RC}$$