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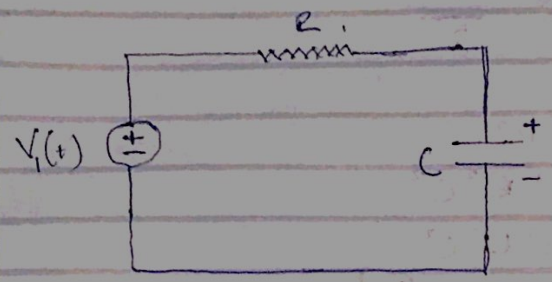
CIRCUIT THEORY.



Soln.

Converting to Frequency domain.

$R \rightarrow R$

$C \rightarrow 1/j\omega C$

$$H(\omega) = \frac{V_o}{V_i}$$

Using Kirchoff Voltage law (Series Connection).

$$H(\omega) = \frac{V_o}{V_i} = \frac{1/j\omega C}{R + 1/j\omega C} = \frac{1/j\omega C}{\frac{Rj\omega C + 1}{j\omega C}}$$

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

when $H(0) = 1$, $H(\infty) = 0$

The half - Power frequency which is equivalent to the corner frequency on the Bode plots but in the context of filters is usually known as Cut off frequency W_c, is obtained by setting magnitude of $H(\omega)$ equal to $1/\sqrt{2}$

$$H(W_c) = \frac{1}{\sqrt{1 + W_c^2 R^2 C^2}} = \frac{1}{\sqrt{2}}$$

making W_o the subject of Formula

Taking the squares of both sides.

$$\frac{1^2}{1 + W_c^2 R^2 C^2} \times \frac{1}{2}$$

$$2 = 1 + W_c^2 R^2 C^2$$

$$2 - 1 = W_c^2 R^2 C^2$$

$$1 = W_c^2 R^2 C^2$$

~~Squaring both sides~~

taking square roots of both sides.

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

$$1 = W_c R C$$

Divide both sides by RC

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