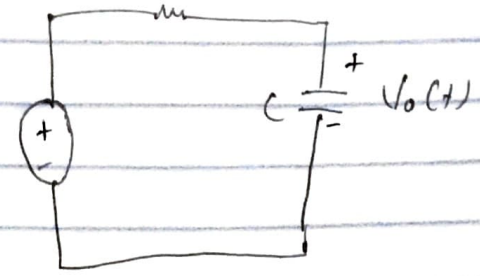
Yahya Fawaz Olawoyin — Circuit theory

17/eng04/075

ELCE - ETE G

Assignment

Determine the type of filter shown below, and show that its cut-off frequency is: $\omega_c = 1/RC$



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

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

$H(0) = 1$: Hence the circuit is a low pass filter

$H(\infty) = 0$

By setting the magnitude of $H(\omega)$ equal to $1/\sqrt{2}$ to obtain cut-off frequency.

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

$$1 = 1$$

$$\sqrt{1 + \omega_c^2 R^2 C^2} = \sqrt{2}$$

$$1 + \omega_c^2 R^2 C^2 = 2$$

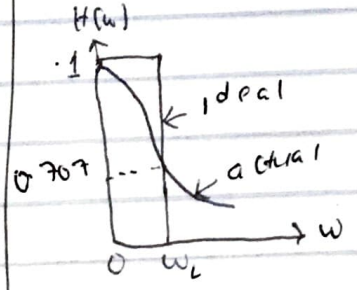
$$\omega_c^2 R^2 C^2 = 2 - 1$$

$$\omega_c^2 R^2 C^2 = 1$$

$$(\omega_c RC) = \sqrt{1}$$

$$\omega_c RC = 1$$

$$\omega_c = 1/RC$$



Ideal and actual frequency response of lowpass filter