

Name : IJIBA OBEKPA

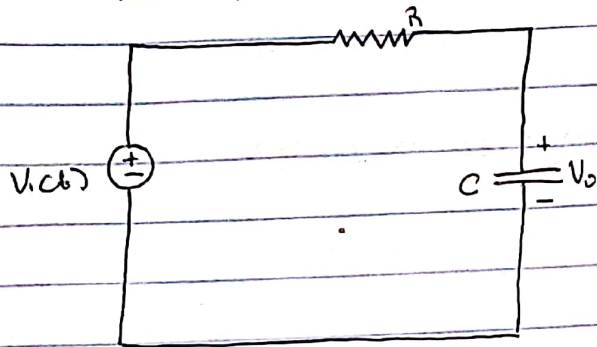
Mat No : 1712MG071030

Department : ELECTRICAL ELECTRONICS ENGINEERING

Course : CIRCUIT THEORY II

Assignment 1

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



Answer

This is a low-pass filter. A typical low-pass filter can be created when the output of an RC circuit is taken of the capacitor

$$\therefore \text{Transfer function} = H(\omega) = \frac{V_o}{V_i} = \frac{1}{R + j\omega C}$$

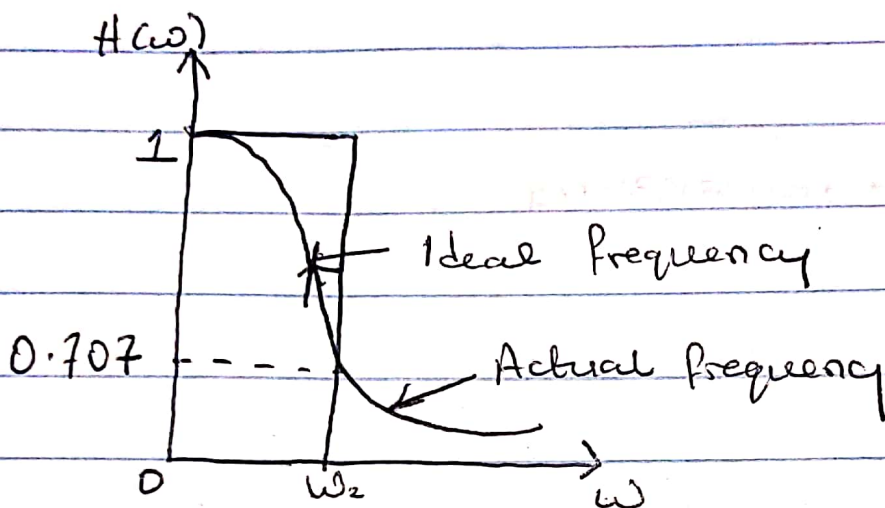
$$H(\omega) = \frac{1}{1 + j\omega RC}$$

Note that $H(0) = 1$, $H(\infty) = 0$

Half power frequency which is equivalent to the corner frequency on the Bode plots but in the context of filters it is usually known as the cut-off frequency ω_c is obtained by setting the magnitude of $H(\omega)$ equal to $1/\sqrt{2}$

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

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



Ideal and actual frequency response
of low pass filter

This cut-off frequency can also be called
the roll off frequency.