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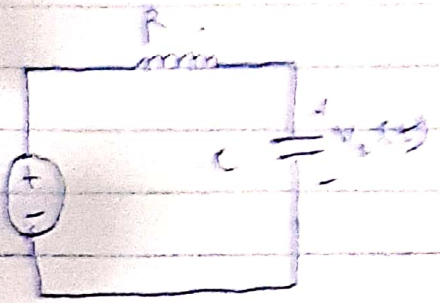
Answer

Since a typical lowpass filter is formed when the output of an RC circuit is taken off the capacitor as shown below

i. The transfer function

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



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

Hence $H(0) = 1$
$H(\infty) = 0$

i) hence the circuit is a low pass filter

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

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

$$1 = 1$$

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

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

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

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

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

$$\omega_c RC = 1$$

$$\omega_c = 1/RC$$