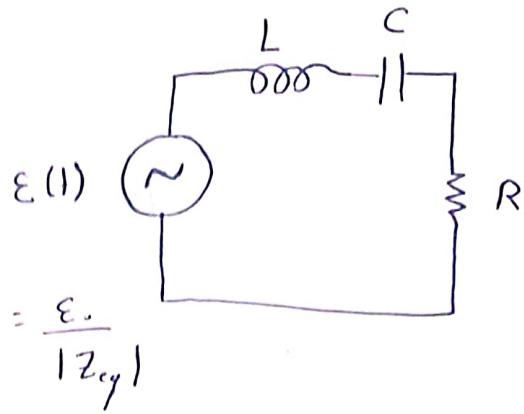


Exp 9: Resonance

$$I(t) = \frac{\varepsilon(t)}{Z_{eq}} = \frac{\varepsilon_0 \cos \omega t}{Z_{eq}}$$

$$= I_0 \cos(\omega t + \phi) \quad ; \quad I_0 = \frac{\varepsilon_0}{|Z_{eq}|}$$



$$I_0 = \frac{\varepsilon_0}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

I_0 depends on " ω " ; it has the max. value when

$$\left(\omega L - \frac{1}{\omega C}\right)^2 = 0 \quad \Rightarrow \quad \omega L = \frac{1}{\omega C} \Rightarrow (X_L = X_C)$$

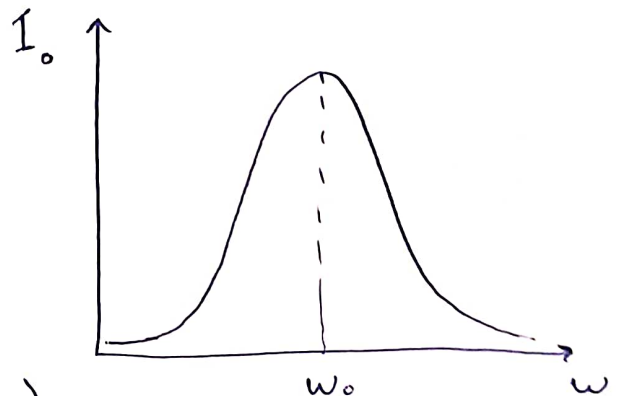
$$\boxed{\omega = \frac{1}{\sqrt{LC}}} \quad \text{The natural freq. } (\omega_0)$$

$$\Rightarrow I_0 = \frac{\varepsilon_0}{R} \quad (\text{max. value of } I)$$

$\Downarrow$

at Resonance

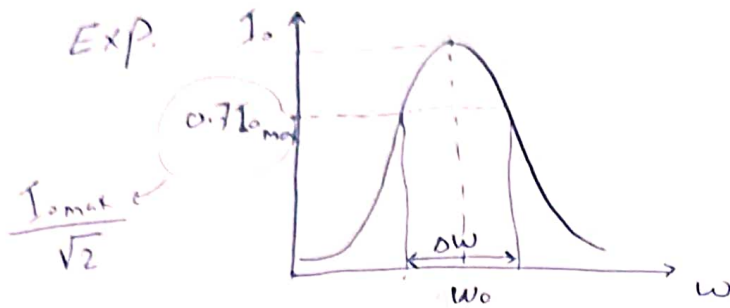
$$\omega_0 = \frac{1}{\sqrt{LC}} \quad (\text{Resonance freq})$$



The Quality Factor:

A measure of the sharpness of the resonance curve.

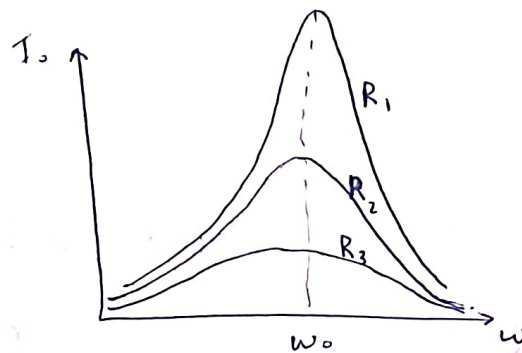
$$Q = \frac{\omega L}{R} = \frac{L}{\sqrt{LC} R} = \frac{1}{R} \sqrt{\frac{L}{C}} \quad (\text{Theo.})$$



$$Q = \frac{\omega_0}{\Delta \omega} \rightarrow \text{bandwidth}$$

$$Q = \frac{1}{R} \sqrt{\frac{L}{C}}$$

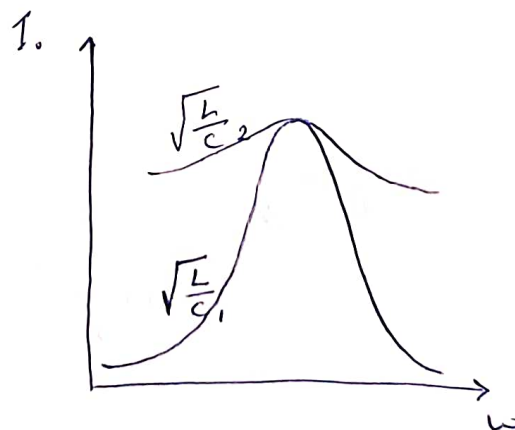
$$Q \propto \frac{1}{R}$$



$$Q_3 < Q_2 < Q_1$$

$$R_3 > R_2 > R_1$$

$$Q \propto \sqrt{\frac{L}{C}}$$



$$Q_1 > Q_2$$

$$\left(\sqrt{\frac{L}{C}}\right)_1 > \left(\sqrt{\frac{L}{C}}\right)_2$$