



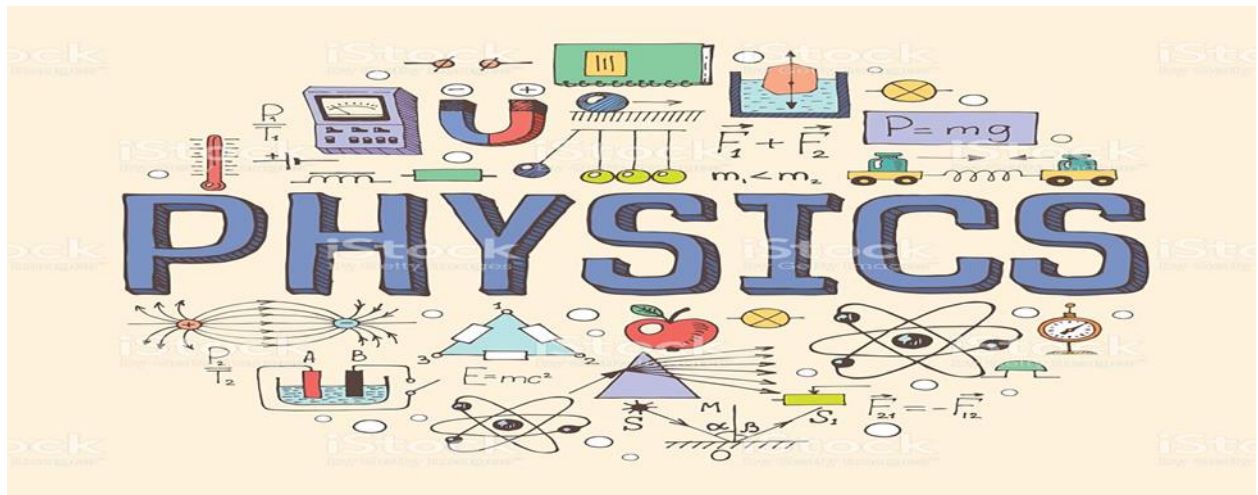
Physics Department

Physics 112

Report 9

Done by :Rayan Ghnimat

“The world is a book and those who do not travel read only one page.”





BIRZEIT UNIVERSITY

Physics Department

Physics 112

Experiment No. 9

RESONANCE

8.5

"كثيري الذين أوتوا العلم الذي أنزل إليك من ربك هو الحق ويهدي إلى صراط العزيز الحميد"

Student's Name: Rayan Ghnimat .

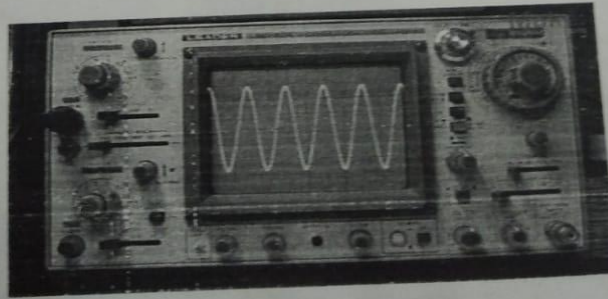
Student's No:1211073.

Partner's Name: Layan,Aya.

Partners' No.: 1211439.

Section No.: 6.

Instructor: Khaled Eid.



- **Abstract**

The aim of the experiment: Is to find out the resonance frequency of the RLC circuit.

The method used: by measuring the characteristics of the LRC circuit, powered by a signal generator, at different frequencies.

- **Introduction:**

At this experiment, we used DCO and Signal Generator to identify the resonance omega and quality factor, using a I vs. ω graph. It aims to find the quality factor at resonance for two different values of R by using specific equations whose parameters we get using the graph.

Calculations

$$\Rightarrow \omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(10 \times 10^{-3}) \times (0.1 \times 10^{-6})}}$$
$$= 31622.78 \text{ Hz.}$$

Theoretical

$$Q = \frac{1}{R} \sqrt{\frac{L}{C}} = \frac{1}{1000} \sqrt{\frac{10 \times 10^{-3}}{0.1 \times 10^{-6}}}$$
$$= 0.316$$

Experiment 9

Resonance

Student's Name: Rayan ghunimat Student's No.: 1211073

Partner's Name: Layan, Aya Partner's No.: 1210768, 1211073

Instructors Name: Khalid Eid Section No.: 6

Date: 11/1/2023

L=10mH;

C=0.1μF;

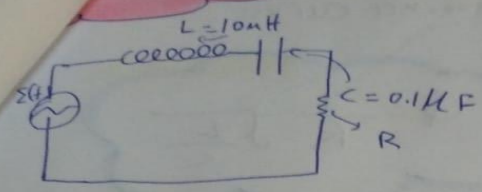
R=1kΩ

$$V_{pp} = 21.2V$$

$$\frac{V_{pp}}{2} = 10.6V$$

f(kHz)	R = 1KΩ		R = 2KΩ	
	V _o (volt)	I _o (mA)	V _o (volt)	I _o (mA)
0.2	2.6	2.6	4.3	4.65
0.3	2.06	2.06	3.8	1.9
0.5	3.18	3.18	5.65	2.825
0.6	3.84	3.84	6.2	3.1
0.8	4.72	4.72	7.3	3.65
1.0	5.65	5.65	8.3	4.15
2.0	8.2	8.2	9.6	4.8
3.0	4.92	4.92	7.7	3.85
4.0	3.42	3.42	6.55	3.275
4.5	3.52	3.52	8.1	3.05
5.0	3.20	3.20	5.7	2.85
5.5	2.92	2.92	5.3	2.65
7.0	2.32	2.32	4.32	2.16
10.0	1.06	1.06	1.33	0.665
20.0	1.45	1.45	1.58	0.79
50.0	0.364	0.364	0.8	0.3
80.0	0.85	0.85	1.15	0.575

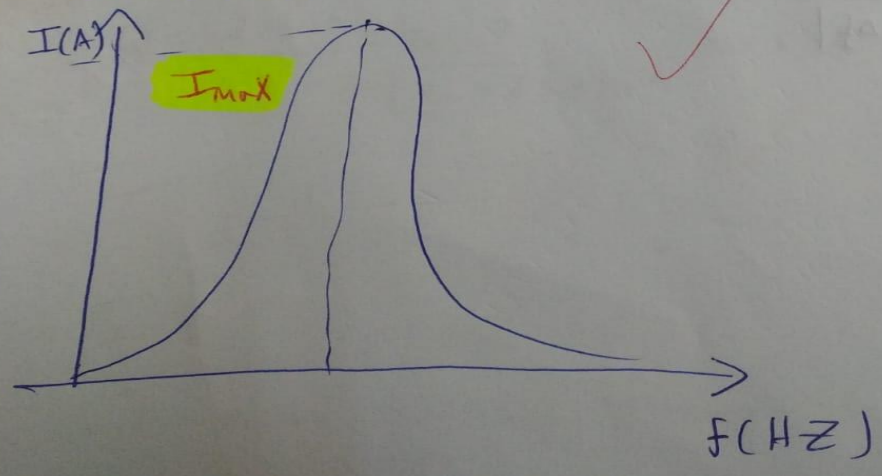
Resonance



$$I_o = \frac{V_o}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}} \Rightarrow I_o \text{ max} \Rightarrow \omega L = \frac{1}{\omega C}$$

Natural Angular frequency $\omega_o = \frac{1}{\sqrt{LC}}$

⊗ $I_o = \frac{V_o}{R}$ → value of current is only limited by resistance of circuit.

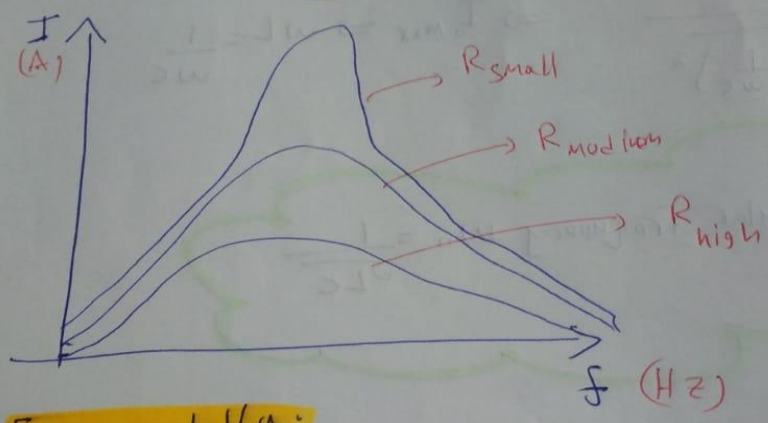


⊗ **Quality Factor** ;

The measure of sharpness of Resonance curve .

$$Q = \frac{wL}{R}$$

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



Experimentally :-

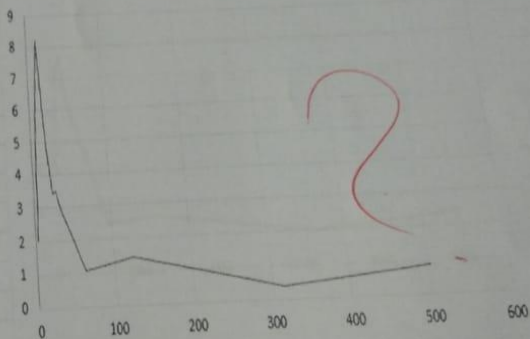
$$Q = \frac{w_0}{|\Delta w|} = \frac{f_0}{|\Delta f|}$$

Data Analysis:

1.884	2.06
3.14	3.18
3.768	3.84
5.024	4.72
6.28	5.65
12.56	8.2
18.84	4.92
25.12	3.42
28.26	3.52
31.4	3.2
34.54	2.92
43.96	2.32
62.8	1.06
125.6	1.45
314	0.364
502.4	0.85

-0.00837

Current vs. Omega Graph



* when $R = 1\text{K}\Omega \Rightarrow I_0 \text{ max} = 8.2 \text{ mA}$,

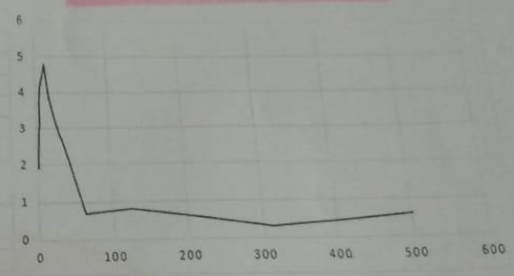
$$Q = \frac{\omega_0}{\Delta\omega} = \frac{2 \times 10^3}{(3 - 0.8) \times 10^2} \Rightarrow Q = 0.9$$

Data Analysis:

1.884	1.9
3.14	2.825
3.768	3.1
5.024	3.65
6.28	4.15
12.56	4.8
18.84	3.85
25.12	3.275
28.26	3.05
31.4	2.85
34.54	2.65
43.96	2.1
62.8	0.665
125.6	0.79
314	0.3
502.4	0.575

-0.00677

CURRENT VS. OMEGA GRAPH



⊗ when $R = 2\text{K}\Omega \implies I_0 \text{ max} = 4.8\text{mA}$

$$Q = \frac{1 \times 10^3}{(4 - 0.8) \times 10^3} = \frac{1}{3.2} = 0.3125 \approx 0.3$$

\swarrow \searrow
 ω_2 ω_1

$$Q = \frac{\omega_0}{\Delta\omega}$$

Conclusion:

We found that current in an RLC circuit has reaches a maximum when the driving voltage frequency is equal to the resonant frequency. We can also conclude that the greater the resistance in an RLC circuit, the small the quality factor.

