

Lab 6: LCR

$$R_1 = 98.9 \pm 0.5\% \Omega$$

$$R_2 = 0.49 \pm 0.5\% k\Omega$$

$$R_c = 193.6 \pm 0.5\% \Omega$$

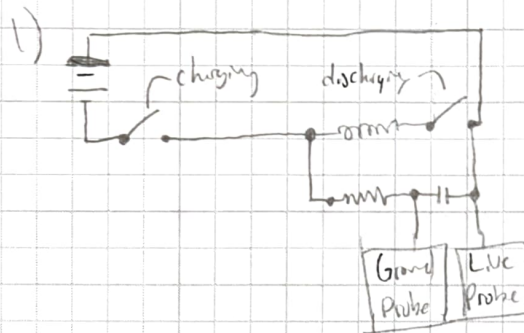
$$L = 88.8 \pm 2\% mH$$

$$C_1 = 21.5 nF \pm 2\%$$

$$C_2 = 0.451 \mu F \pm 2\%$$

This lab is about running the oscillation & decay for LCR circuits.

Procedure:



2) Swap out the capacitor & resistor to various values

3) Charge, then measure the discharge over time

4) Fit the result to $y = A e^{-t/\tau} \sin(\omega t - \phi)$

5) Calculate $\omega = 1/\sqrt{LC}$ and $\omega' = \sqrt{\omega^2 - 1/\tau^2}$ for both fitted & calculated values

6) Compare ω' & τ for both data.

(τ)

(ω)

	$C = 21.5 nF \pm 2\%$	$C = 0.451 \mu F \pm 2\%$	$C = 0.451 \mu F \pm 2\%$	$C = 0.451 \mu F \pm 2\%$
	$R = 98.9 \pm 0.5\%$	$R = 98.9 \pm 0.5\%$	$R = 98.9 \pm 0.5\%$	$R = 98.9 \pm 0.5\%$
A	7.943	1.067	1.030	1.342
	± 0.1162	± 0.009915	± 0.01227	± 0.01179
L	0.0008031	0.0008416	0.0005544	0.0001954
	± 0.0001726	± 0.0000974	± 0.00007727	± 0.00003627
W	2328	4946	4728	5979
	± 22.09	± 9.573	± 11.41	± 6.048
P	4.000	-0.7884	-0.7768	1.151
	± 0.01452	± 0.005706	± 0.006140	± 0.01523

$$\delta\omega' = \sqrt{\left(\frac{\omega}{\omega'}\right)^2 + \left(\frac{1/\tau}{\omega'}\right)^2}$$

$$= \frac{1}{\omega'} \sqrt{\left(\frac{\omega}{\omega'}\right)^2 + \left(\frac{1/\tau}{\omega'}\right)^2}$$

$$\delta\omega = \frac{1}{2\omega} \left[\left(\frac{1}{L^2}\right)^2 + \left(\frac{1}{C^2}\right)^2 \right]^{1/2}$$

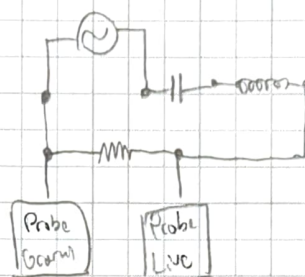
$$\delta\tau = \tau \left[\left(\frac{1}{L^2}\right)^2 + \left(\frac{1}{R^2}\right)^2 \right]^{1/2}$$

$$R = 0.99 \pm 0.5\% \text{ k}\Omega$$

$$L = 88.8 \pm 2\% \text{ mH}$$

$$C = \cancel{0.0047} \mu\text{F}$$

$$0.0047 \pm 2\% \mu\text{F}$$



$$V_{in} = 16.000 \text{ V}$$

$$\text{Max Freq} = 7.67 \text{ kHz}$$

kHz Freq in	V V _{pp} out
7.67	11.12
2.20	1.11
28.4	1.11
10.63	5.56
5.86	5.56
3.72	2.22
16.9	2.22
13.3	3.33
4.73	3.33
5.36	4.44
11.7	4.44
9.92	6.67
6.22	6.67
6.493	7.76
9.43	7.76
8.98	8.88
6.77	8.88
7.1	10.08
8.5	10.00
3.0	1.66
20.9	1.66
14.62	2.80
4.3	2.80

- 1) Assemble circuit
- 2) Vary Function generator frequency
- 3) Find max out put w/ Probe
(at its corresponding freq)
- 4) Record frequency for out put voltages of
10%, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90% of
max voltage
- 5) Plot freq vs. output V, fit this curve.
- 6) Fit data