☐ PHYS1050 / ☐ PHYS1250
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Laboratory Worksheet

Experiment NE05 - LRC Series Circuit

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Name: _____ **Student ID:** _____ **Date:** _____

Exp 1: Table 1.1 the amplitudes for current I, p.d. across resistor V_R, p.d. across inductor V_L, and p.d. across resistor V_C

f (Hz)	i		V_R	
	Amplitude (A)	ϕ (Radian)	Amplitude (V)	ϕ (Radian)
10				
45				
90				
95				
100				
150				
160				
170				
200				
225				
300				
400				
500				

f (Hz)	V_L		V_C	
	Amplitude (V)	ϕ (Radian)	Amplitude (V)	ϕ (Radian)
10				
45				
90				
95				
100				
150				
160				
170				
200				
225				
300				
400				
500				

Experiment 2: Data Analysis of experiment 1

Table 2.1 p.d. across capacitor vs. frequency

Inverse fit	**Value**
A (Scale factor)	
B (Y Offset)	

Table 2.2 p.d. across inductor vs. frequency

Linear fit	**Value**
m (Scale factor)	

Table 2.3 Resonant frequency

Intersect of two curves:	
***x* coordinate**	***y* coordinate**
Resonant frequency (Hz)	**Value of p.d. across capacitance or p.d. across inductor (V)**

Experiment 3: Finding the properties of the LRC circuit at resonant frequency

Table 3.1 the amplitudes and phase angles for current i, p.d. across resistor V_R, p.d. across inductor V_L and p.d across capacitor V_C at resonant frequency f_o.

f_o **(Hz)**	i **(A)**	V_R **(V)**	V_L **(V)**	V_C **(V)**
	ϕ_i (Radian)	ϕ_R (Radian)	ϕ_L (Radian)	ϕ_C (Radian)

Discussion

Experiment 1: Finding the resonant frequency through curves fitting

1. Using Table 1.1 to finish the following tables. According to the data in Table 1.2, what is the resonant frequency f_o ? State your selection criteria. (Hints: Consider the conditions for LRC circuit series resonant shown in Page 16.). Which range of frequency make the capacitive LRC circuit (i.e. $X_C > X_L$) or inductive LRC circuit (i.e. $X_L > X_C$)?

Table 1.2 fine turning for finding the resonant frequency

f **(Hz)**	Experimental phase angle $\phi = \tan^{-1}\left(\frac{V_L - V_C}{V_R}\right)$ (Unit: Radian)
10	
45	
90	
95	
100	
150	
160	
170	
200	
225	
300	
400	
500	

The resonant frequency located should be between_____Hz to_____Hz

The capacitive LRC circuit (i.e. $X_C > X_L$) behaves between_____Hz to_____Hz

The inductive LRC circuit (i.e. $X_L > X_C$) behaves between_____Hz to_____Hz

Experiment 2: Data Analysis of experiment 1

2. **What is the mathematical express of A (Scale factor) in terms of capacitance C and inductance L respectively in Table 2.1 and 2.2?**

3. **Ideally, the capacitive reactance is inversely proportional to the frequency. (i.e. B (Y Offset) in Table 2.1 is zero). What is the physical meaning of B (Y Offset)?** (Hints: Consider the physical meaning of y-axis of Figure 23) **In this experiment, why the B(Y Offset) is not zero? (**Hints: equation (38) is proved assuming that the capacitor only has pure capacitive reactance; B(Y-offset) is independent of frequency and connecting this two factors with Figure 23)

The physical meaning of B (Y Offset) is _____

4. **By using equations (38) and (53), calculate the capacitive reactance and inductive reactance at the experimental resonant frequency found in Table 2.3. Hence, calculate the percentage difference of the experimental value and theoretical value of resonant frequency, capacitive reactance and inductive reactance.**

	Theoretical value (Copy from Prelab Q.4)	Experimental value	Percentage difference $= \frac{\text{Theoretical} - \text{Experimental}}{\text{Theoretical}} \times 100\%$
Resonant frequency			
Capacitive reactance			
Inductive reactance			

5. **Account for the discrepancy between the experimental and theoretical values in Discussion Q.4.**