EELE 250 Circuits, Devices, and Motors

Lab #5: Frequency Response

Scope:

- Study the steady-state (AC) response of RL and RC circuits.
- Use of the signal generator and the oscilloscope.
- Represent signals with phasors: magnitude and phase.

Home preparation:

- Review Hambley chapters 5 and 6.
- Read through the experiment and plan out each step.
- Create tables in your notebook with the calculated values and space to enter the measured results for the experiment.
- Prepare the calculated results for the circuits you will be measuring in the lab, **write the results in your lab notebook**, and fill out the **prelab sheets**.

Laboratory experiment:

1. RC Circuit with steady-state AC source

Breadboard circuit Fig. 5.1 using the signal generator and components from your lab kit.

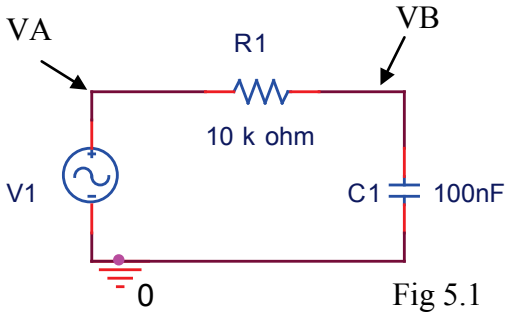

Fig 5.1

Set the signal generator to produce a 10 V peak-to-peak (10V p-p = ±5V = 5V peak) sinusoidal signal.

Attach the 2-channel oscilloscope to observe simultaneously the voltage signals VA and VB.

Remember to connect the signal generator ground to the circuit and at least one ground clip of the o-scope probes.

- Observe and record the peak-to-peak voltages at VA and VB for the three frequencies: 16 Hz, 160 Hz, and 1.6 kHz.
- For each frequency, determine the gain magnitude |VB|/|VA| and the phase angle between input (VA) and output (VB) voltages, and complete Table 5.1.

Table 5.1: RC Circuit Response			
Lab Measurements:	**16 Hz**	**160 Hz**	**1,600 Hz**
V_A			
V_B			
$\lvert V_B \rvert / \lvert V_A \rvert$ (gain mag.)			
Phase: V_B relative to V_A			

2. RL Circuit with steady-state AC source

Breadboard the circuit shown in Fig. 5.2

Adjust the signal generator to produce a 5 Vp-p sinusoidal signal.

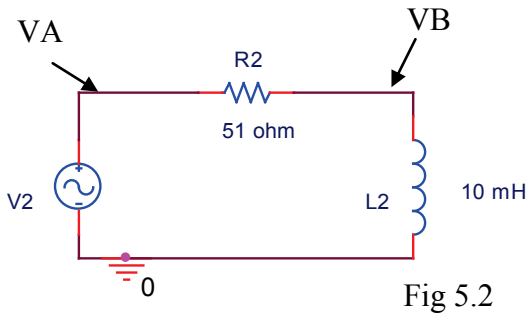

Fig 5.2

- Using the oscilloscope, simultaneously observe VA and VB for the frequencies: 800 Hz, 8 kHz, 80 kHz.
- For each frequency, determine the magnitude of the gain and the phase angle between input and output voltages, and complete Table 5.2.

Table 5.2: RL Circuit Responses			
Lab Measurements:	**800 Hz**	**8 kHz**	**80 kHz**
V_A			
V_B			
$\lvert V_B \rvert / \lvert V_A \rvert$ (gain mag.)			
Phase: V_B relative to V_A			

Before leaving the lab, turn off the lab equipment, return cables and probes to the rack, carefully collect your belongings, straighten up your lab area, and don't forget to check-out with your TA.

PRELAB SHEETS

Perform the calculations before coming to lab, and show a summary of your work. Your lab TA will collect this sheet at the start of the lab period for grading.

RC Circuit with steady-state AC source

For the circuit of Fig. 5.1, assume V1 is a 10 V peak-to-peak (10V p-p = ±5V = 5V peak) sinusoidal signal.

- Calculate the peak-to-peak values of VA and VB for the three frequencies: 16 Hz, 160 Hz, and 1.6 kHz .
- For each frequency, determine the gain magnitude |VB|/|VA| and the phase angle between input (VA) and output (VB) voltages, and complete the table below.

Prelab Calculations: Fig 5.1	**16 Hz**	**160 Hz**	**1.6 kHz**
V_A			
V_B			
$\lvert V_B \rvert / \lvert V_A \rvert$ (gain mag.)			
Phase: V_B relative to V_A			

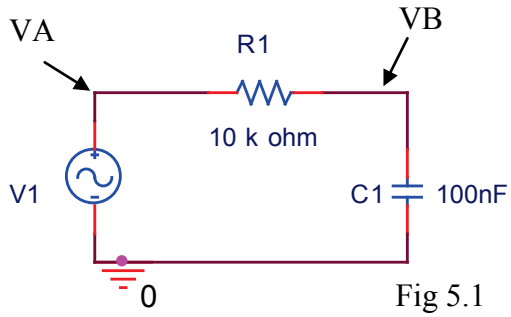

Fig 5.1

RL Circuit with steady-state AC source

For the circuit of Fig. 5.2, assume V2 is a 5 V peak-to-peak (5V p-p = ±2.5V) sinusoidal signal.

- Calculate the peak-to-peak values of VA and VB for the three frequencies: 800 Hz, 8 kHz, and 80 kHz .
- For each frequency, determine the gain magnitude |VB|/|VA| and the phase angle between input (VA) and output (VB) voltages, and complete the table below.

Prelab Calculations: Fig 5.2	**800 Hz**	**8 kHz**	**80 kHz**
V_A			
V_B			
$\lvert V_B \rvert / \lvert V_A \rvert$ (gain mag.)			
Phase: V_B relative to V_A			

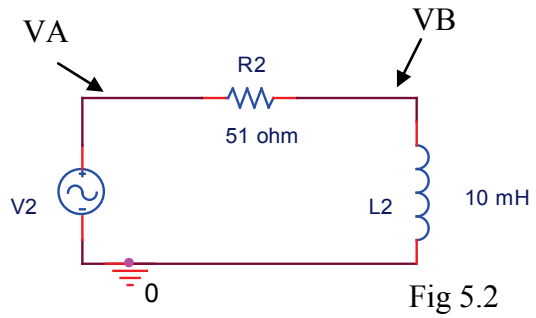

Fig 5.2