COMMUNICATION SYSTEMS (ECE 437)

LABORATORY MANUAL

EXPERIMENT 1

School of Engineering and Computer Science

Oakland University

LABORATORIES PROCEDURES:

LAB REPORTING:

1. Lab report must be written neatly consists of the followings:
   - Experiment introduction and theory/derivation.
   - Results and Simulation.
   - Result discussion and conclusion.
2. Each group must publish their own lab report.
3. Each lab report is due 1 week after the experiment.
4. Please remember that the students are supposed to bring their own **BREADBOARD** for the experiment.

LAB SCHEDULES:

Group A:	Day: Tuesday	Time: 2.00 – 5.00pm
Group B:	Day: Wednesday	Time: 12.00 – 3.00 pm

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LAB INSTRUCTOR: Mohd Haris Bin, Md Khir
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LAB NO.: 1 [Fourier Analysis and LC-Filter Circuit Characteristics.]

OBJECTIVES:

1. To study the filtering characteristics of an LC tuned circuit.
2. To study the spectra of different waveforms using the LC tuned circuit.

EXPERIMENTAL PROCEDURES:

1. Using phasor analysis (from EE 222), derive an expression for V_{out}/V_{in} in terms of frequency (w) for the LC band-pass filter circuit shown below in **Figure 1**. From this derivation, find an expression for the center frequency w_c of the circuit. (The center frequency is the frequency at which the magnitude is maximum and the phase is zero.)

2. Design an LC band-pass filter such that the center frequency f_c = 250 KHz with a 3 db bandwidth of 10KHz. (Note 3 db bandwidth of 10 KHz means that at f_c +/- 5KHz, the gain V_{out}/V_{in} will be -3 db.) This can be done by first obtaining the expression for w_c, which will be in terms of L and C only. Choose L and solve for C, and then substitute L, C and w = 2*pi*(250 +/- 5 KHz) into the formula for the magnitude of V_{out}/V_{in} and set it equal to 0.707 (which is -3 db.).

3. Measure the frequency response of the filter, i.e. for a set of frequency values approximately between 100 KHz and 300 KHz, determine the gain V_{out}/V_{in} for each frequency and plot it as a function of frequency. Take measurements at frequency values closer together when it becomes apparent that the gain is changing rapidly. (Note: Use Sine wave inputs only for the frequency response as it has no harmonics.).

4. Display (and take a print out of) the frequency response of the circuit on the oscilloscope-based Frequency Response Analyzer shown below in **Figure 2**. [Note: Please note that neither of the two waveteks should have a DC offset. The output on the screen of the oscilloscope displays the frequency response of the circuit with horizontal axis being the frequency and the vertical axis being the magnitude. To determine the horizontal scale of the frequency response analyzer, experiment with

the VCG input on a wavetek by applying a voltage from the power supply to it, and vary this voltage to note the effect on the frequency response of the wavetek output.]

5. Now apply the Triangular and the Square wave to the input of the LC circuit and use it to measure the Fourier series (FS) coefficients of the waves (upto about 5^{th} harmonic or so), utilizing the property of the LC band-pass filter that it can pass only one harmonic at a time to its output while suppressing all other harmonics. In other words, set the frequency of the input signal and the center frequency of the filter such that the frequency of the filter is the appropriate harmonic of the input. Also, calculate the theoretical values of the FS coefficients and compare them with the ones obtained experimentally.

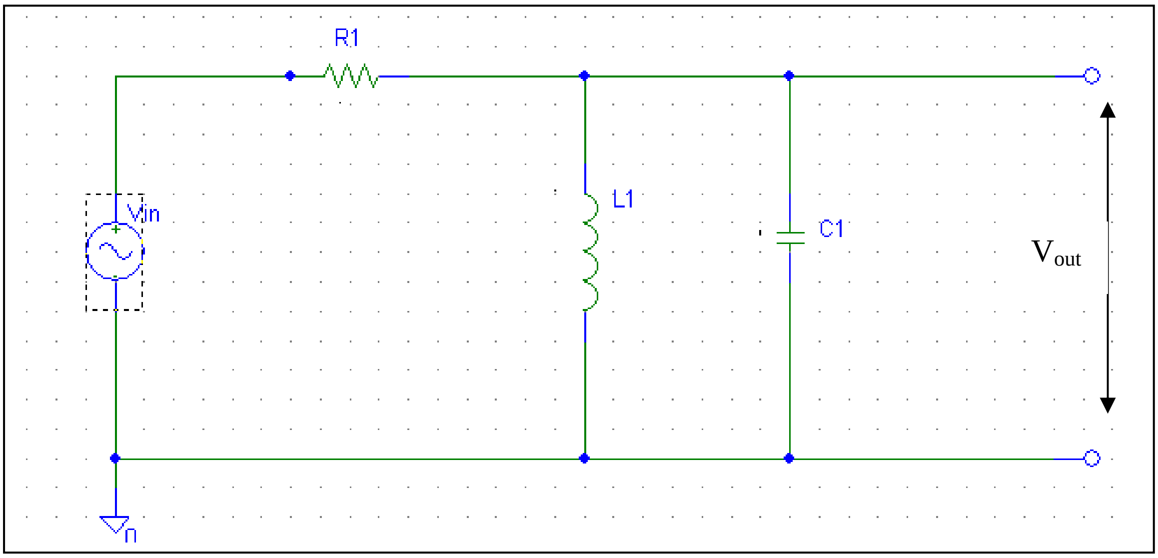

Figure 1: Passive Band Pass filter using L C circuit

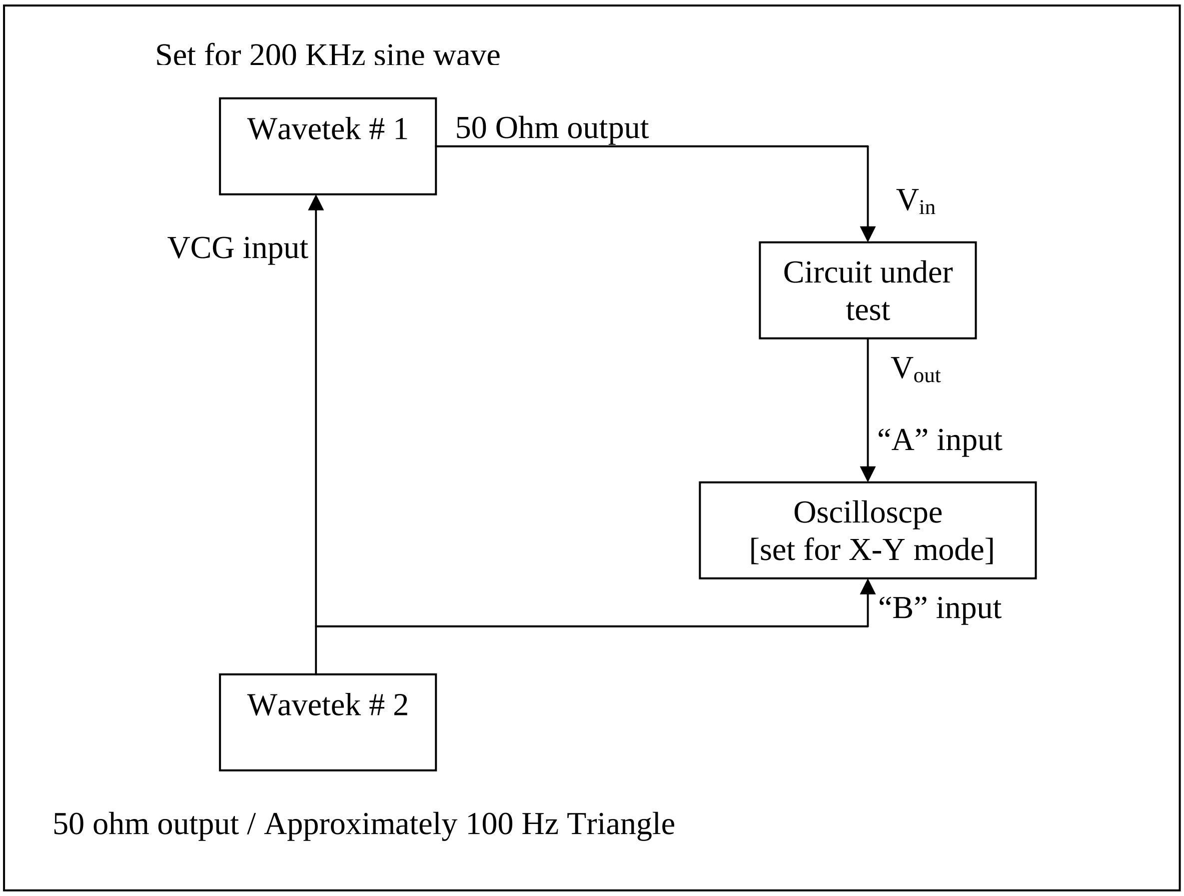

Figure 2: Schematic Diagram of Frequency Response Analyzer