EEEN203 Electric Transformers Laboratory

Objectives of this laboratory:

1. Measure some of the circuit parameters (currents and voltages) of a physical transformer to understand how transformers work.
2. Analyse the transformer's frequency response.
3. Analyse the transformer's frequency response with a capacitive load.

Experimental Procedure

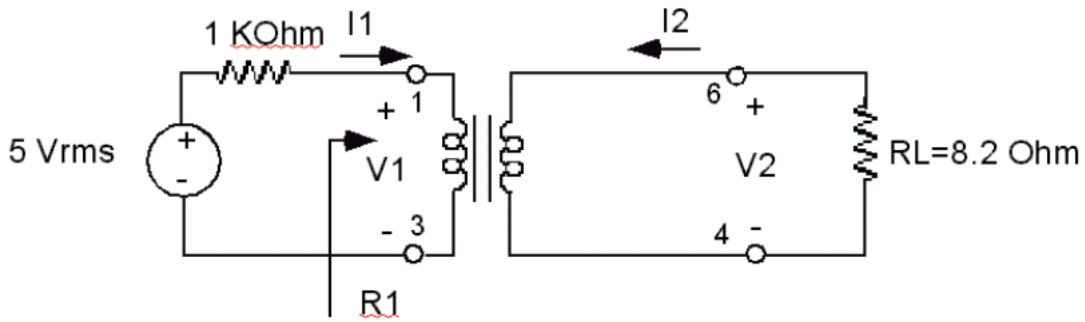
Equipment Needed:

- Audio transformer
- Function Generator
- Oscilloscope
- Power Supply
- Multimeter
- Scope probes
- 8.2 Ω, 1KΩ resistors, 68nF capacitor

Note: For your calculations you can use either amplitude or RMS values. Just be consistent.

Part 1: Voltage and Current measurements in a Transformer

1. Build the circuit in the following configuration (Fig 1). Use an 8.2Ω resistor as a load resistor. For source resistance, use a 1KΩ resistor. Connect a function generator and provide an output sinusoid of $5V_{RMS}$ and 1 kHz (check using an oscilloscope).



2. Measure the voltages V1 and V2 over the primary and secondary coils using the oscilloscope. Calculate the turns ratio ***n*** of the transformer using (V2/V1) and 1/***n***. Observe the phase of V2 with reference to V1 and comment.
3. Measure the voltage over the 1 kΩ resistor and calculate the corresponding current I1 in the primary coil. You can use a multimeter to determine the measurement (Beware that the multimeter provides rms values). Find the current I2 in the secondary side. Calculate the current ratio and compare it with the voltage ratio.
4. Use the measured values of V1 and I1 and determine the resistance on the primary side.
5. Using the measured values of current and voltage, calculate the power delivered by the function generator and the power absorbed by the resistors. Compare the generated and dissipated power and explain how the transformer is non-ideal.

Part 2: Transformer Frequency Response

The goal of this experiment is to measure the frequency response over a frequency range. You will also measure the response at higher frequencies and measure the resonant frequency.

1. Connect the function generator to the transformer side with higher number of coils (step-down configuration) and leave the secondary side open. Apply a 10 Vp-p, 1 kHz sine waveform. Using a 1:1 scope probe, measure the secondary voltage.
2. By varying the frequency on the function generator, we will observe the frequency response of the transformer. Vary the frequency from 100Hz to 1MHz on a log scale and obtain a frequency response curve for |V2/V1|. Also measure the phase of V2 with respect to V1.
3. Increase the frequency until you observe the output voltage (secondary voltage) increases rapidly. Note the frequency of resonance. Perform several measurements around the resonant frequency to plot a frequency response curve (20Log|V2/V1| (dB) vs Frequency).

Part 3: Transformer Resonance with Capacitive load

This section is to analyse the effect of load on a Transformer. During this experiment, you will add a large capacitor on the load side (secondary side) and observe its effect on the frequency response.

1. Connect the transformer in the same configuration as in Part 2 (Signal generator on transformer side with large number of coils, 10 Vp-p, 1 kHz sine waveform).
2. On the secondary side, connect a 68nF capacitor. Record V1 and V2 for frequencies between 100Hz and 1MHz.
3. Find the resonant frequency and note measurements around the frequency and plot the frequency response graph. Compare the frequencies with response from Part 2.
