Name: ____ **Date:** ____________________

Introduction

In this exercise you will investigate Thevenin's Theorem by experimentally determining the Thevenin Equivalent of a circuit, and comparing the response of a specific load to both the original circuit and the circuit's Thevenin Equivalent.

PreLab

Determine the Thevenin parameters for the circuit shown in Figure 4.1 with respect to the load resistor R_L connected between terminals "T" and "H". (Your calculations must verify your results.)

$\tilde{V}_{TH}$ = ______________________________ V Z_{TH} = ______________________________ Ω

Have your instructor verify your prelab calculations/results. **Instructor Initials:** _________

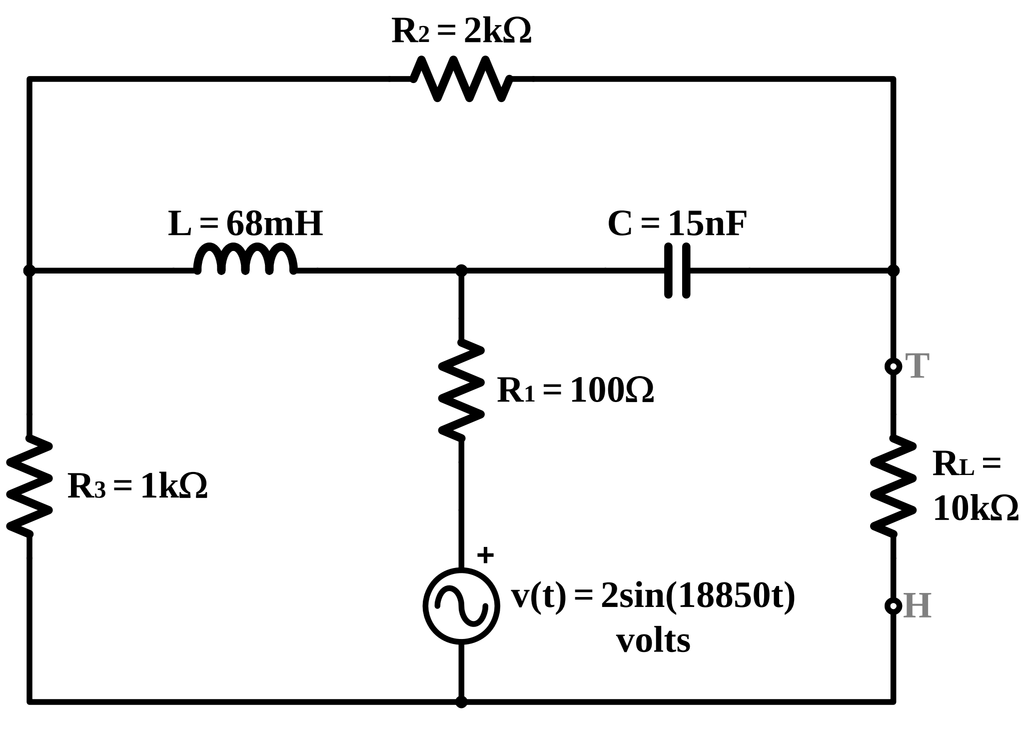

Figure 4.1 – RLC Circuit

Procedure

1. Connect the circuit shown in Figure 4.1. Be sure to set the source voltage to $2V_{peak}$ after the source is connected to the circuit.

2. Measure the load voltage and calculate the load current (in phasor form), with the phase angles referenced to the voltage source in the circuit having a phase angle of zero degrees.

$\tilde{V}_L =$ ______________________________ V $\tilde{I}_L =$ ______________________________ A

3. Determine the Thevenin Voltage – Remove the load and measure the open-circuited voltage between terminals "T" and "H".

$\tilde{V}_{OC} = \tilde{V}_{TH} =$ ______________________________ V

4. Determine the Thevenin Impedance – The Thevenin Impedance will be determined by taking the ratio of the (open-circuit) Thevenin Voltage and the (short-circuit) Norton Current.

To determine the (short-circuit) Norton Current, place a small "current-sampling" resistor ($R_S = 10\Omega$) between terminals "T" and "H". If R_S is sufficiently small, the rest of the circuit will react to the sampling resistor as if it were a "short-circuit".

Measure the voltage across the sampling resistor, $\tilde{V}_S$, and determine the "short-circuit" current.

$\tilde{V}_S =$ ______________________________ V

$$\tilde{I}_{SC} = \frac{\tilde{V}_S}{R_S} = \tilde{I}_N = \text{\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_} \text{ A}$$

Calculate the Thevenin Impedance and express the result in rectangular form ($Z_{TH} = R_{TH} + jX_{TH}$).

$$Z_{TH} = \frac{\tilde{V}_{TH}}{\tilde{I}_N} = \text{\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_} \ \Omega$$

5. Determine the series components that compose the Thevenin Impedance.
(I.e. – a resistor in series with either an inductor on a capacitor)

$R_{TH} =$ ________________________ Ω L_{TH} or $C_{TH} =$ ________________________ H or F

6. Using a set of "decade" boxes set to your Thevenin component values, construct the Thevenin Equivalent Circuit and connect the load resistor, R_L, between terminals "T" and "H". Be sure to set the magnitude of $\tilde{V}_{TH}$ appropriately and to account for its phase angle.

Measure the load voltage and calculate the load current.

$\tilde{V}_L =$ ______________________________ V $\tilde{I}_L =$ ______________________________ A

Have your instructor verify your measured results. **Instructor Initials:** __________

Report Guide

1. Accurately sketch the Thevenin equivalent circuit using the values obtained in steps 3 and 5.

2. Compare the Thevenin Equivalent parameters obtained from your prelab calculations to those derived from your measured values. Explain any differences.

3. Explain why was a 10Ω resistor used instead of a short circuit when determining I_{SC}?
(Hint – think about the scope's measurement capabilities.).

4. Compare the measured load voltage and current values obtained with the load connected to the original circuit to those obtained with the load connected to the Thevenin Equivalent Circuit.

Approved by (Instructor): ______________________________ **Date: _______________**