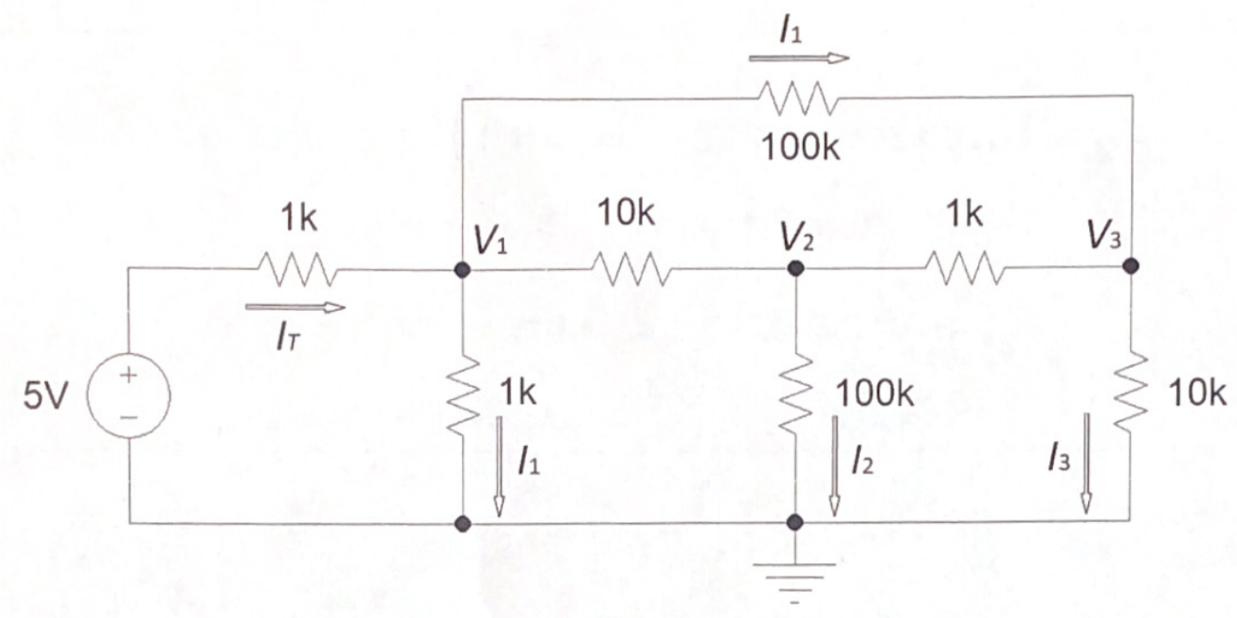
ELECENG 2CI5 Lab 4 Prelab

Raeed Hassan
hassam41

i.



Node 1

$$\frac{V_1}{1k} + \frac{V_1 - V_2}{10k} + \frac{V_1 - V_3}{100k} - \frac{V_1 + 5V}{1k} = 0$$
$$100V_1 + 10V_1 + V_1 + 100V_1 - 10V_2 - V_3 - 500V = 0$$
$$211V_1 - 10V_2 - V_3 = 500V \quad (1)$$

Node 2

$$\frac{V_2 - V_1}{10k} + \frac{V_2 - V_3}{1k} + \frac{V_2}{100k} = 0$$
$$-10V_1 + 10V_2 + 100V_2 + V_2 - 100V_3 = 0$$
$$-10V_1 + 111V_2 - 100V_3 = 0 \quad (2)$$

Node 3

$$\frac{V_3}{10k} + \frac{V_3 - V_2}{1k} + \frac{V_3 - V_1}{100k} = 0$$
$$-V_1 - 100V_2 + 10V_3 + 100V_3 + V_3 = 0$$
$$-V_1 - 100V_2 + 111V_3 = 0 \quad (3)$$

$$\begin{array}{c} (1) \\ (2) \\ (3) \end{array} \begin{bmatrix} 211 & -10 & -1 \\ -10 & 111 & -100 \\ -1 & -100 & 111 \end{bmatrix} \begin{bmatrix} V1 \\ V2 \\ V3 \end{bmatrix} = \begin{bmatrix} 500 \\ 0 \\ 0 \end{bmatrix}$$

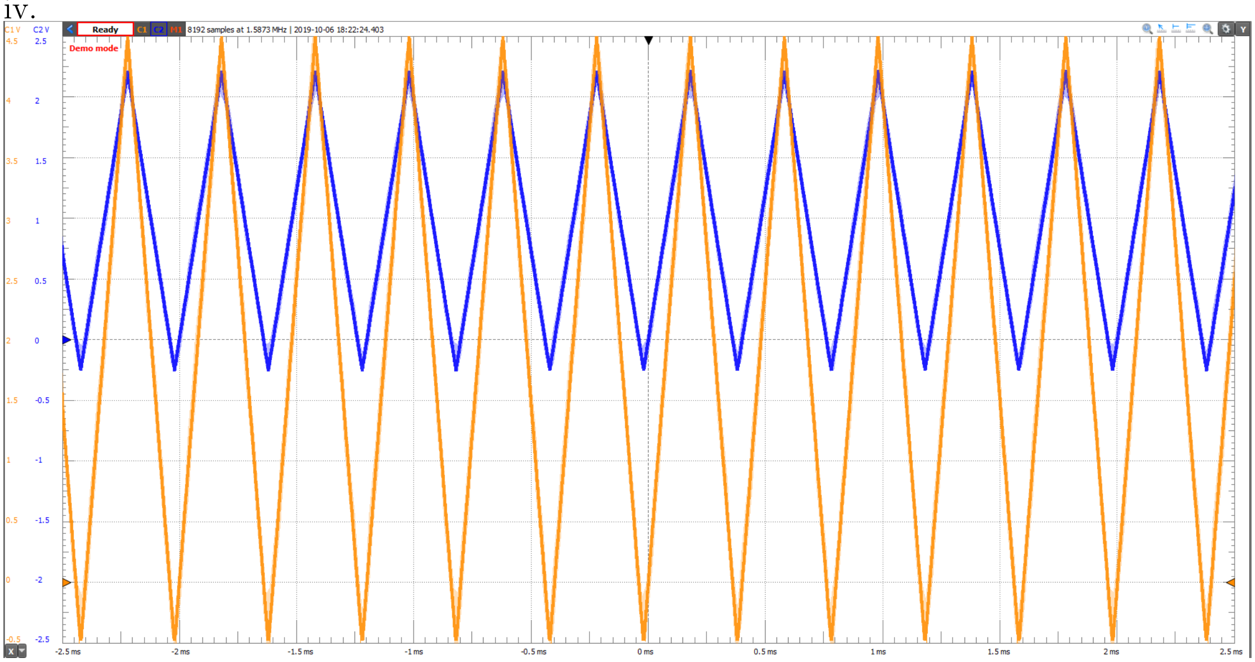
$$\begin{bmatrix} V1 \\ V2 \\ V3 \end{bmatrix} = \begin{bmatrix} 2.4354 \\ 1.2696 \\ 1.1657 \end{bmatrix}$$

$$I_T = \frac{5V - V_1}{1k} = \frac{5 - 2.4354}{1k} = 0.002565A = 2.565mA$$
$$I_1 = \frac{V1}{1k} = \frac{2.4354}{1k} = 0.002435A = 2.435mA$$
$$I_2 = \frac{V2}{100k} = \frac{1.2696}{100k} = 0.01270mA$$
$$I_3 = \frac{V3}{10k} = \frac{1.1657}{10k} = 0.1166mA$$
$$I_4 = \frac{V_1 - V_3}{100k} = \frac{2.4354 - 1.1657}{100k} = 0.01270mA$$

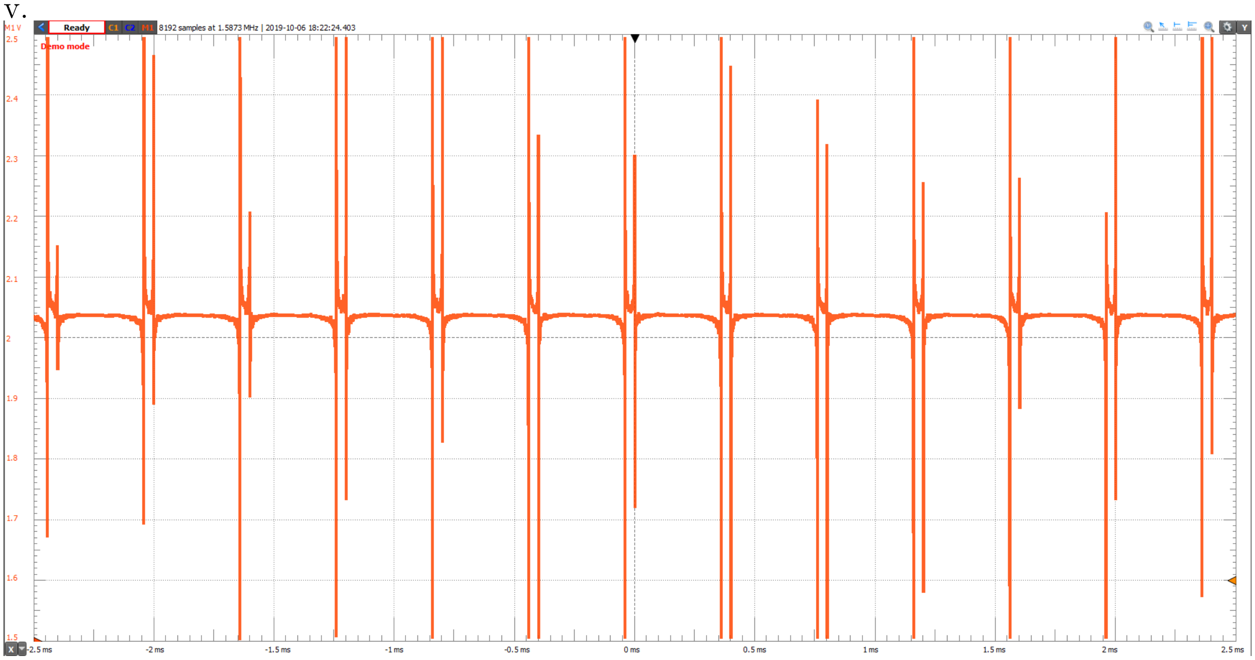
ii.
$V_1 = 2.554$V
$V_2 = 1.266$V
$V_3 = 1.160$ V
$I_T = 2.558$ mA
$I_1 = 2.443$ mA
$I_2 = 0.01270$ mA
$I_3 = 0.1166$ mA
$I_4 = 0.01262$ mA

iii. The ratio of the input voltage to V_1 is $\frac{5V}{2.554V} = 1.958V$, the ratio of the input voltage to V_2 is $\frac{5V}{1.266V} = 3.949V$, and the ratio of the input voltage to V_3 is $\frac{5V}{1.160V} = 4.310$.

iv.



v.



The ratio displayed on the oscillioscope (approximately 2.05) is relatively close to the ratio calculated in part iii (approximately 1.96).