Principles of EE I Laboratory

Lab 7

Mesh and Nodal Analysis of AC Circuits

Student A	Student B
Full name: ……	Full name: ……
Student number: ……	Student number: ……

I. Objectives

In this laboratory, you will investigate:

1. The AC mesh-current technique.
2. The AC node-voltage technique.
3. Generation of an AC source using a phase-shifting network.

II. Procedure

***You must provide all calculations in-details in separate sheets and/or simulation results as attachments**

Student A	Student B

1. Mesh-current Analysis

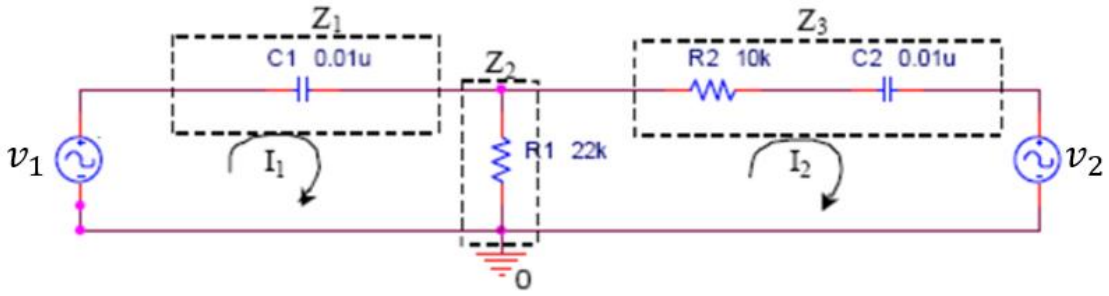

Figure 1. AC network used in the mesh-current analysis

Prelab: Calculation/Simulation:

Using the mesh-current technique to complete Table 1. Given that:

$v_1(t) = 5\sin(2\pi 1000t + 0°)$ [V]

$v_2(t) = 3\sin(2\pi 1000t - 46°)$ [V]

In-class procedure:

Construct the AC circuit shown in Figure 1. Using oscilloscope:

a. To measure and record the input voltages v_1 and v_2. Verify the phase shift between them.
b. To measure the V_{Z1}, V_{Z2}, V_{Z3}. Students need to get the probe 1 and probe 2 connect correctly in the circuit.
c. Compare the errors between calculated/simulated and measured values. Draw a conclusion about the accuracy of your simulation and measurements.

Table 1. Data for circuit in Figure 1

	$V_{peak}\angle\phi°$	
	Calculated/simulated	Measured
V_{Z1}		
V_{Z2}		
V_{Z1}		
I_1		
I_2		

2. Node-voltage Analysis

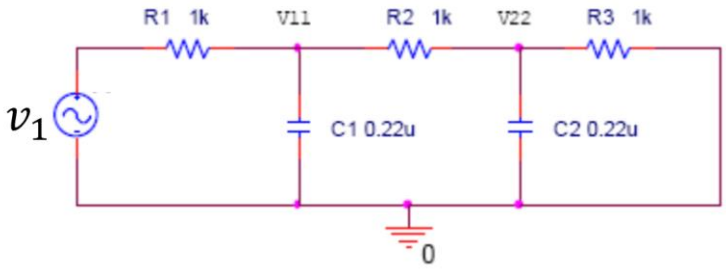

Figure 2. AC circuit used in the Node -voltage Analysis

Prelab: Calculation/Simulation:

Using the mesh-current technique to complete Table 2. Given that:

$v_1(t) = 5\sin(2\pi 1000t + 0°)$ [V]

In-class procedure:

Construct the AC circuit shown in Figure 2. Using oscilloscope:

a. To measure voltages and complete Table 2. Students need to get the probe 1 and probe 2 connect correctly in the circuit
b. Compare the errors between calculated/simulated and measured values. Draw a conclusion about the accuracy of your simulation and measurements.

Table 2. Data for circuit in Figure 2

	$V_{peak}\angle\phi°$	
	Calculated/ Simulated	Measured
V_{R1}		
V_{C1}		
V_{R2}		
V_{C2}		
V_{R3}		
V_{11}		
V_{22}		

Hints: V_{11} &V_{22} *can be calculated via the Nodal Voltage Theorem as follow:*

$$\frac{V_{11}-V_1}{Z_{R1}}+\frac{V_{11}}{Z_{C1}}\frac{V_{11}-V_{22}}{Z_{R2}}=0$$

$$\frac{V_{22}-V_{11}}{Z_{R2}}+\frac{V_{22}}{Z_{C2}}+\frac{V_{22}}{Z_{R3}}=0$$