EET 1150

1. **LAB NUMBER: 5**

2. **TITLE: Series - Parallel Circuit Analysis**

3. OBJECTIVES:

After completing this lab, the student will be able to:

1. measure the amplitude and phase of total current,
2. measure the amplitude and phase of branch currents,
3. verify Kirchhoff's Current Law,
4. verify the Current Divider Rule.

4. EQUIPMENT:

METEX MS-9150 Generator
Oscilloscope
Experimenter board
Multisim software

5. COMPONENTS:

1 - 10 Ω ½ watt 5% Resistor
1 - 560 Ω ½ watt 5% Resistor
1 - 33 nF Capacitor
1 - 15 mH Inductor

6. TEXT REFERENCE:

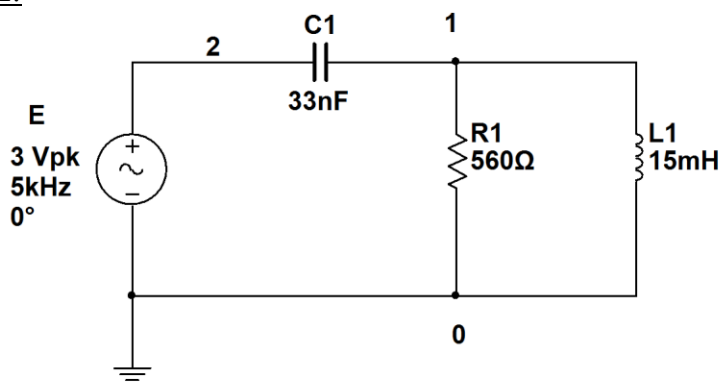
Circuit Analysis: Theory and Practice (5^{th} Edition):
A.H. Robbins and W.C. Miller

Section 18.6: Series - Parallel Circuits

7. PRE-LAB ASSIGMENT:

Study the circuit of Fig. 1 then do the required calculations:

Figure 1:



a) Calculate the reactances of C1 and L1, then determine the parallel branch impedance Zp and the total impedance Z_T as seen by the source. Record your results in Table 1.

Table 1:

R1	X_{C1}	X_{L1}	Z_P	Z_T
560 Ω < 0°	Ω< °	Ω< °	Ω< °	Ω< °

b) Convert E into phasor form with magnitude in RMS value and angle 0° then calculate the total current. Record your result in Table 2:

Table 2:

I_T	I_{R1}	I_{L1}
mA< °	mA< °	mA< °

c) Use the Current Divider Rule and calculate the branch currents. Record your results in Table 2.

$$I_x = \frac{Z_P}{Z_x} I_T$$

d) Check you results by applying Kirchhoff's Current Law at node 1. Show your calculations.

e) Calculate the Power P dissipated by R1 using the magnitude of I_{R1}.

f) Calculate P again using the real part of Z_T and magnitude of I_T. Compare to the result in (e).

8. MEASUREMENTS:

A – Measurement of Total Current It:

a) Build the circuit of Fig. 2. Resistor R3 is the sense resistor for measuring It. CH1 measures the output of the Generator. Set this output to 3 V peak. CH2 measures the voltage of R3 (convert to RMS) which gives us It. Measure VR3 magnitude and phase and calculate It. Record your results in Table 3. Note: All black clips must be connected together at point "0".

Figure 2:

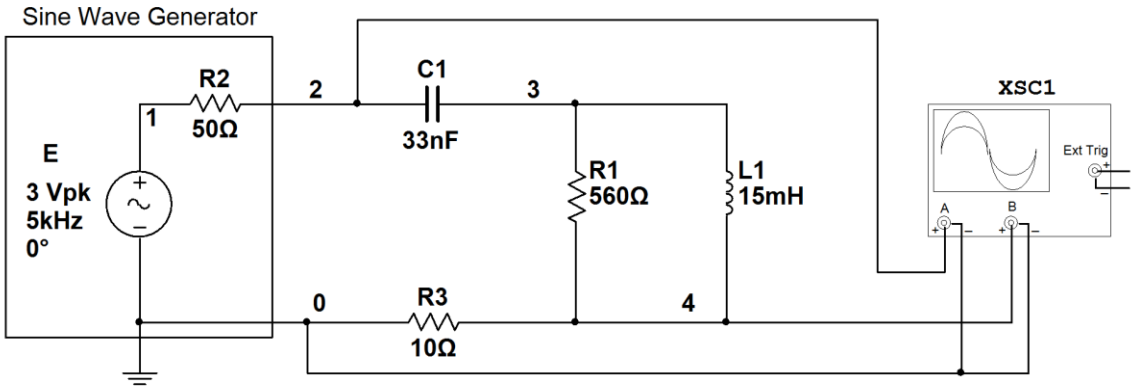


Table 3:

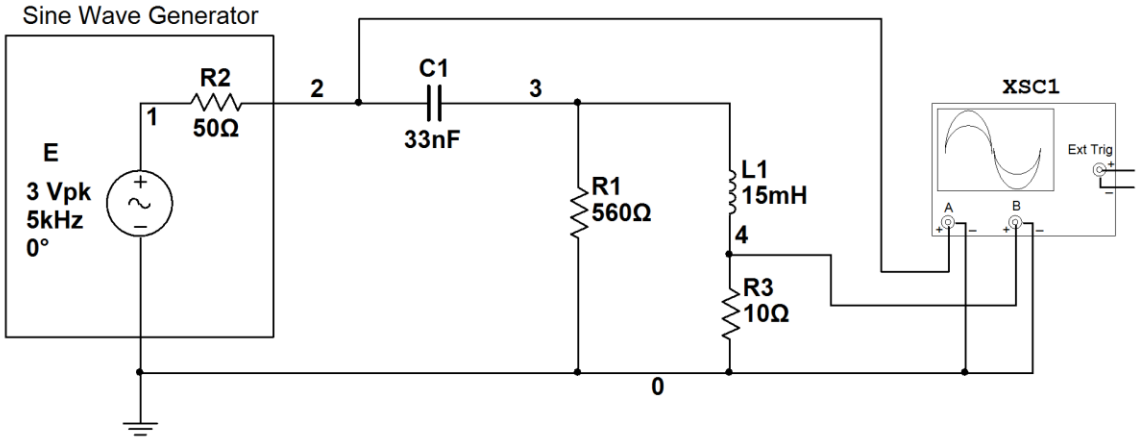
VR3	I_T
mV< °	mA< °

b) Compare this I_T to that of Table 2.

B- Measurement of Branch Currents:

c) Build the circuit of Fig. 3.

Figure 3:



d) Resistor R3 is moved to measure the current of L1 with the help of CH2. After that, move CH2 to point "3" to measure VR1 and its phase so the current through R1 can be determined. Record your results in Table 4.

Table 4:

VR1	VR3
V< °	V< °
I_{R1}	I_{L1}
mA< °	mA< °

e) Compare these currents to those of Table 2.

C – Multisim Simulation:

f) Create a Multisim circuit of Fig. 1. Insert 3 Multimeters in the circuit to measure the total and branch currents. Set all Multimeters to AC current.
g) Activate the simulations to measure the three currents. Print the simulations with the circuit.

9. LAB REPORT REQUIREMENT:

Your team's Lab Report should contain the followings:

A Cover Page with Lab Number, Lab Title, Team members' Names and Date.
An Introductory Page with list of Equipment and Components used.

Result Pages with:

A – Measurement of Total Current It:

Procedure:

(Summarize the main activities that your team did (past tense) in this section).

Results:

Show a copy of Table 3.

Discussions:

1) Answer 8 (b).
2) Determine factors that produce the differences.
3) Propose a method using this measured It to determine the total impedance Z_T.

B- Measurement of Branch Currents:

Procedure:

(Summarize the main activities that your team did (past tense) in this section).

Results:

Show a copy of Table 4.

Discussions:

1) Answer 8 (e).
2) Determine factors that produce the differences.
3) Explain the results of the comparison 7 (e) to 7 (f).

C – Conclusions:

1) Is Kirchhoff's Current Law valid for this series – parallel circuit? Explain your answer.

2) Is the Current Divider Rule accurate for this series – parallel circuit? Explain your answer.

3) Are all the Lab objectives met? Explain if some are not.

Appendix:

Attach Multisim simulations and all Pre-Lab calculations.