EXPERIMENT 2
IMPEDANCE MEASUREMENT

OBJECTIVE

Impedance measurements of capacitors and Inductors.

EQUIPMENT

Oscilloscope, DMM, Function Generator, 1 kohm and 500 ohm resistors, 5 mH inductor, 1 uF capacitor

PRELIMINARY WORK

P1 Find a method and describe your method in details to determine the inductance L of a coil by using the readings of the meters shown in Figure 1. AVO8 is used as ampermeter and Oscilloscope is used as voltmeter. Be careful the RMS and peak values of the instruments. Oscilloscope measures in peak values and Ampermeters measures in RMS values. R_{in} is the internal resistance of the inductor. The internal resistance of inductor R_{in} can be measured by a DMM. R=1k ohm

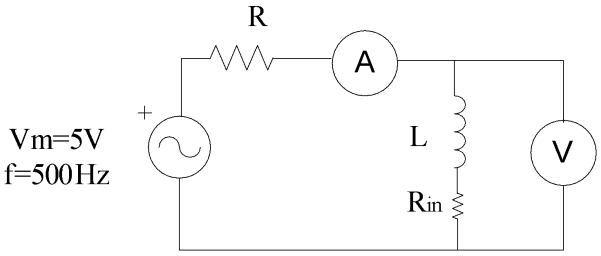

Figure 1 Measurement of inductance

P2 Find a method to determine the capacitance value of the capacitor using the readings of the meters. R=1k ohm

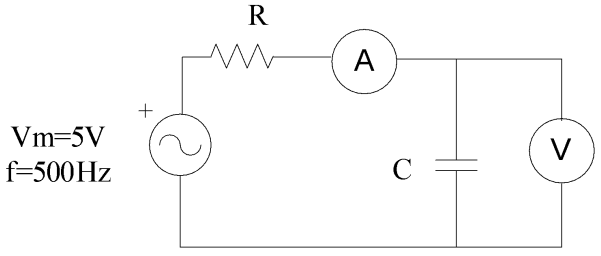

Figure2 Measurement of capacitance

P3

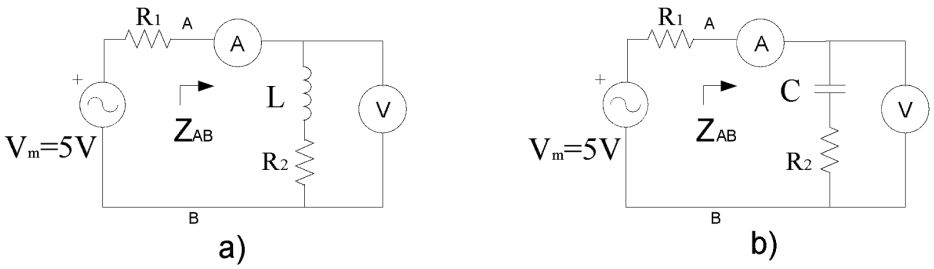

Figure 3

Fill in the following table for the circuit given in Figure 3 a) Take $V_s = 5\angle 0^\circ$ R_1=1k, R_2=100 ohm and L=5mH. All values must be in phasor domain. For example phasor domain equivalence of 3+4j is $5\angle 53{,}13$. **Plot $|Z_{AB}|$ versus frequencies in table** 1

Frequency	V_s	V_{AB}	V_R	$I=V_{R1}/R_1$	$Z_{AB}=V_{AB}/I$
500					
1000					
1500					
2000					
3000					
4000					
5000					
6000					
8000					
10000					

Table 1

P4 Repeat P3 for the circuit given in Figure 2 b). All values must be in phasor domain. **Plot $|Z_{AB}|$ versus frequencies in table 2.** C=1uF

Frequency	V_s	V_{AB}	V_{R1}	$I=V_{R1}/R_1$	$Z_{AB}=V_{AB}/I$
500					
1000					
1500					
2000					
3000					
4000					
5000					
6000					
8000					
10000					

Table 2

EXPERIMENTAL WORK

E1 Measure the winding resistances of 5mH coils by DMM. Setup the circuit shown in figure 1, and determine the inductance values of the coils using the method you propose in P1

E2 Setup the circuit shown in figure 2, and determine the capacitance values of the 1uF capacitor using the method you propose in P2.

E3 Setup the circuit given in figure 3 a) Fill in the table 1 just using the magnitude values. **Plot $|\mathbf{Z_{AB}}|$ versus frequency**

E4 Setup the circuit given in figure 3 b) Fill in the table 2 just using the magnitude values. **Plot $|\mathbf{Z_{AB}}|$ versus frequency**

CONCLUSION

C1 Consider P1 and P2. Is there any difference between actual values and experimental values for calculating inductance and capacitance values? State possible reasons

C2 What happens to $|Z_{AB}|$ when frequency is increased for E3? Why?

C3 What happens to $|Z_{AB}|$ when frequency is increased for E4? Why?