XMUT204 Electronic Design

Laboratory 1: Instrumentation – DC Measurements (Questions)

Due Date: Labs 1 is not for submission.

Complete a short report on your Lab 1 by providing the following results from your measurements and adding your conclusions where requested. Also add graphs and tables as appropropriate.

Section A1 – Continuity with DMM

Show a basic sketch of your breadboard and indicate the internally electrically connected pattern on the board. [5 marks]

Section A2 – Current and voltage measurements

a. Show your calculated currents and voltages for the circuit in Figure 1. [10 marks]
b. Show the measured values of current and voltage in your constructed circuit. [5 marks]
c. How big are the differences between calculated observed values of the currents and voltages? Discuss the possible source(s) of these differences. [5 marks]

Section A3 - Internal resistance of ammeter and voltmeter.

a. Show the expected voltages calculated across R_A and R_B for the different values. [5 marks]
b. Show your expression for the actual voltages observed when the meter with resistance R_M is in place. [5 marks]
c. Use a table to show your expected voltages across R_A and R_B for the different resistances as well as different values of R_M. [10 marks]
d. How does the accuracy of the measurements depend upon the relationship between R_M and R_A and R_B? What value of R_M is necessary for the measured voltage to be accurate? Explain the influence of R_M in obtaining accurate measurements. [5 marks]

Section A4 - Voltage divider circuits

a. Write an expression for the voltage that will be observed over R_B in terms of R_A, R_B and the supply voltage V_S. [5 marks]
b. Sketch the circuit for your voltage divider design. Indicate the values of all resistors in your design. [5 marks]

c. Show the results of your voltage divider test and comment on the results. [5 marks]
d. Show your values of Vout as obtained for different values of the load resistance. Explain your observations and how this may limit the use of such a voltage divider circuit as a stable voltage source in a circuit. [5 marks]
e. Sketch the circuit for your advanced voltage divider circuit. [5 marks]

Section A5 - Resistance measurement with DMM

a. Show your resistance measurements of different resistors and also the % difference from the indicated value. Comment on the observed difference vs. The expected tolerance from the resistor. [5 marks]
b. For the circuit experiments:
    i. Determine the voltage across each resistor and the current flowing in each resistor. [7.5 marks]
    ii. Determine the voltage across each resistor and the current flowing in each resistor. [7.5 marks]

Additional Question

Briefly discuss three things that you have learned from this lab. [5 marks]

Marking Schedule

Student Name : _____

Student ID : _____

No	Section	Mark	Your Mark	Remarks
	Questions			
1	Show a basic sketch of your breadboard and indicate the internally electrically connected pattern on the board.	5		
2	• Show your calculated currents and voltages for the circuit in Figure 1.	10		
	• Show the measured values of current and voltage in your constructed circuit.	5		
	• How big are the differences between calculated observed values of the currents and voltages? Discuss the possible source(s) of these differences.	5		
3	• Show the expected voltages calculated across R_A and R_B for the different values.	5		
	• Show your expression for the actual voltages observed when the meter with resistance R_M is in place.	5		
	• Use a table to show your expected voltages across R_A and R_B for the different resistances as well as different values of R_M.	10		
	• How does the accuracy of the measurements depend upon the relationship between R_M and R_A and R_B? What value of R_M is necessary for the measured voltage to be accurate? Explain the influence of R_M in obtaining accurate measurements.	5		
4	• Write an expression for the voltage that will be observed over R_B in terms of R_A, R_B and the supply voltage V_S.	5		
	• Sketch the circuit for your voltage divider design. Indicate the values of all resistors in	5		

	your design.			
	• Show the results of your voltage divider test and comment on the results.	5		
	• Show your values of Vout as obtained for different values of the load resistance. Explain your observations and how this may limit the use of such a voltage divider circuit as a stable voltage source in a circuit.	5		
	• Sketch the circuit for your advanced voltage divider circuit.	5		
5	• Show your resistance measurements of different resistors and also the % difference from the indicated value. Comment on the observed difference vs. The expected tolerance from the resistor.	5		
	• For the circuit experiments:			
	(i) Determine the voltage across each resistor and the current flowing in each resistor.	7.5		
	(ii) Determine the voltage across each resistor and the current flowing in each resistor.	7.5		
	Additional Questions			
6	Briefly discuss three things that you have learned from this lab.	5		
	Total	100		

Comment: