Lab Practical Practice Version **Name:_____**

On this exam you are expected to work ahead. I will come around periodically and check any parts you have completed. Credit will be given on an all or nothing basis for each part. Blowing a fuse will reduce your score by 1 point in addition to any points lost for that particular question. Negative scores are possible.

Note: on this practice test you will see more than 11 pnts total. I have written 8 different versions of the lab practical. On each version I choose to leave out some of these options. Most students find the actual exam questions to be slightly easier than these. For instance, the Excel questions will not be quite as demanding.

1) (2pnts) Set-up an LRC series circuit using a function generator operating at 620 kHz sine wave. **Crank the amplitude all the way up.** This step is required for problem 2. If you can't do it I will do it for you so you can try problem 2 but you will receive no credit for problem 1. **Show this to your instructor.**
2) (1 pnt) Determine which circuit element (L, R, or C) has the largest peak-to-peak voltage. Hint: it may be worthwhile to float the scope to remove grounding issues. **Show your measurement of the largest peak-to-peak voltage to your instructor and write down the value (with units) here.**
3) (0.5 points) Which circuit element (L, R, or C) should be measured to determine the current in the circuit? You need not determine this current, just tell me which circuit element should be measured.

4) (2pnts) Set-up a function generator to produce a sine wave with a frequency of 3.5 kHz. **Crank the amplitude all the way up.** Connect the circuit to two random resistors in series. This step is required for problem 3. If you can't do it I will do it for you so you can try problem 3 but you will receive no credit for problem 2. **Show this to your instructor.**
5) (2pnts) Use an oscilloscope to display voltage across one of your resistors from the previous question to your instructor. Determine both period of the waveform AND the RMS *current* through the resistor for the waveform. **Show this to your instructor. Write down your measurement including units. You might need to show a little bit of work on this paper.**

6) (0.5 pnt) What does the vertical axis on the oscilloscope screen represent? **Circle the best answer and show it to your instructor.**

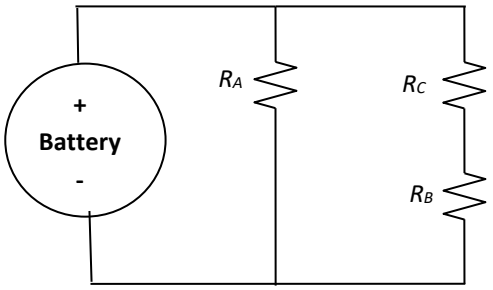
Resistance	Current	Charge	Frequency
Voltage	Capacitance	Time	None of these

7) (0.5 pnt) What does the horizontal axis on the oscilloscope screen represent? **Circle the best answer and show it to your instructor.**

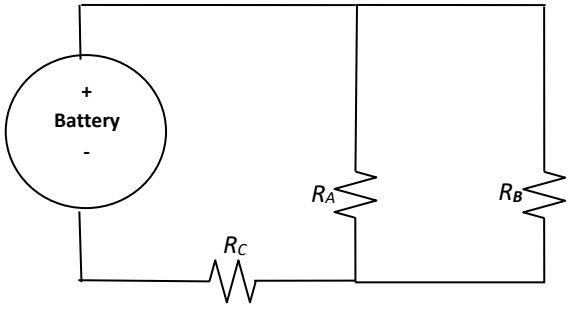
Resistance	Current	Charge	Frequency
Voltage	Capacitance	Time	None of these

8) (1 pnt) Demonstrate how to measure the resistance of a resistor. **Show this to your instructor**.
9) (1 pnt) Demonstrate how to measure the voltage across a battery. **Show this to your instructor**.
10) (3 pnts) Obtain three resistors with resistances greater than $10\ \Omega$. Set up a series circuit with all three resistors and a DC power supply set to 5.00 V. Perform a four point (four probe) measurement on one of the resistors. **List the measurement from each of the two DMMs with units and show it to your instructor**. **Also, determine the resistance of the resistor from the two DMM readings. Include appropriate units on everything.**

11) (3pnts) Connect the following circuit. Measure the current through resistor B and the voltage across resistor A. **Show your current measurement to your instructor (a calculated current gets no points). You must use the DMM in current measuring mode for credit. That said, you can always *check* your work by measuring the voltage across and dividing by the resistance determined by the DMM.**
Write down both measurements with units so I know you understand how to get units off the DMM.



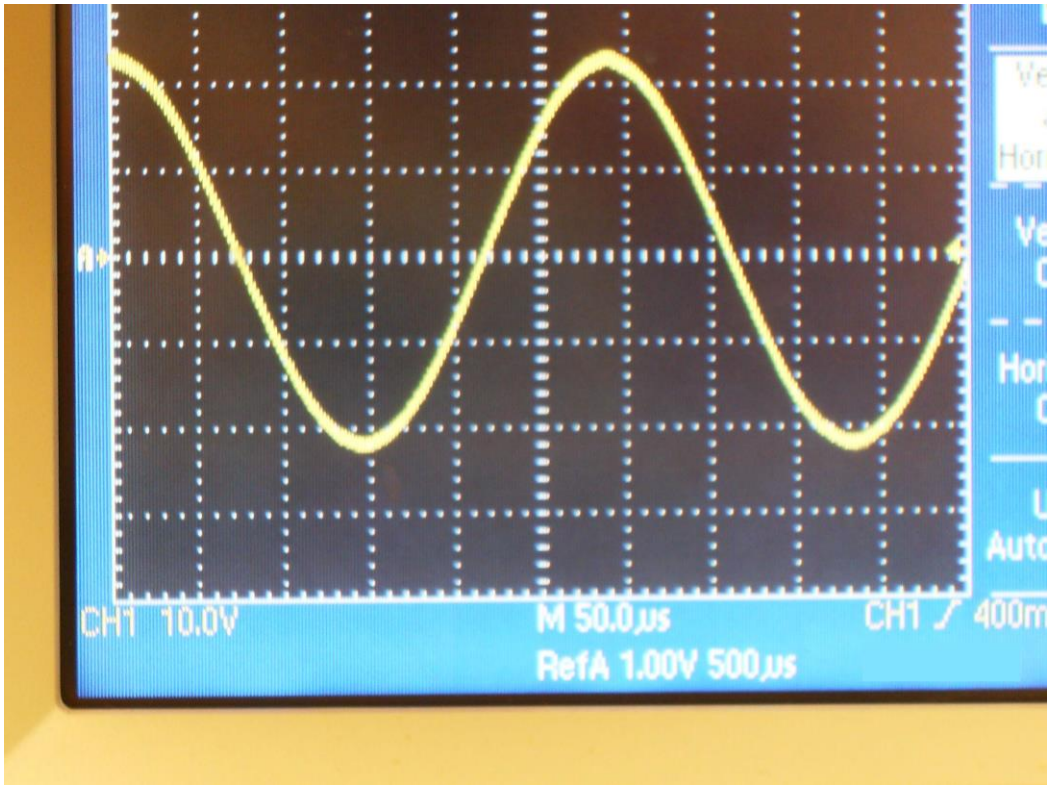
12) (3pnts) Connect the following circuit. Measure the current through resistor B. Connect the following circuit. Measure the current through resistor B and the voltage across resistor A. **Show your current measurement to your instructor (a calculated current gets no points). You must use the DMM in current measuring mode for credit. That said, you can always *check* your work by measuring the voltage across and dividing by the resistance determined by the DMM.**
Write down both measurements with units so I know you understand how to get units off the DMM.



13) (1-2pnts) Look at the graph below and fill in the table. Be sure all answers include appropriate units!!! Expect different screen shot on the exam.

Note: On exam day expect to be asked about one or two of these, not the entire table. Remember that peak, max and amplitude all mean the same thing. Peak is half of peak to peak. RMS is peak divided by $\sqrt{2}$. Also $\omega = 2\pi f = \frac{2\pi}{T}$.

Freq = f	
Angular freq = ω	
Period = T	
V_{pk-pk}	
V_{pk}	
V_{rms}	
$Amplitude$	

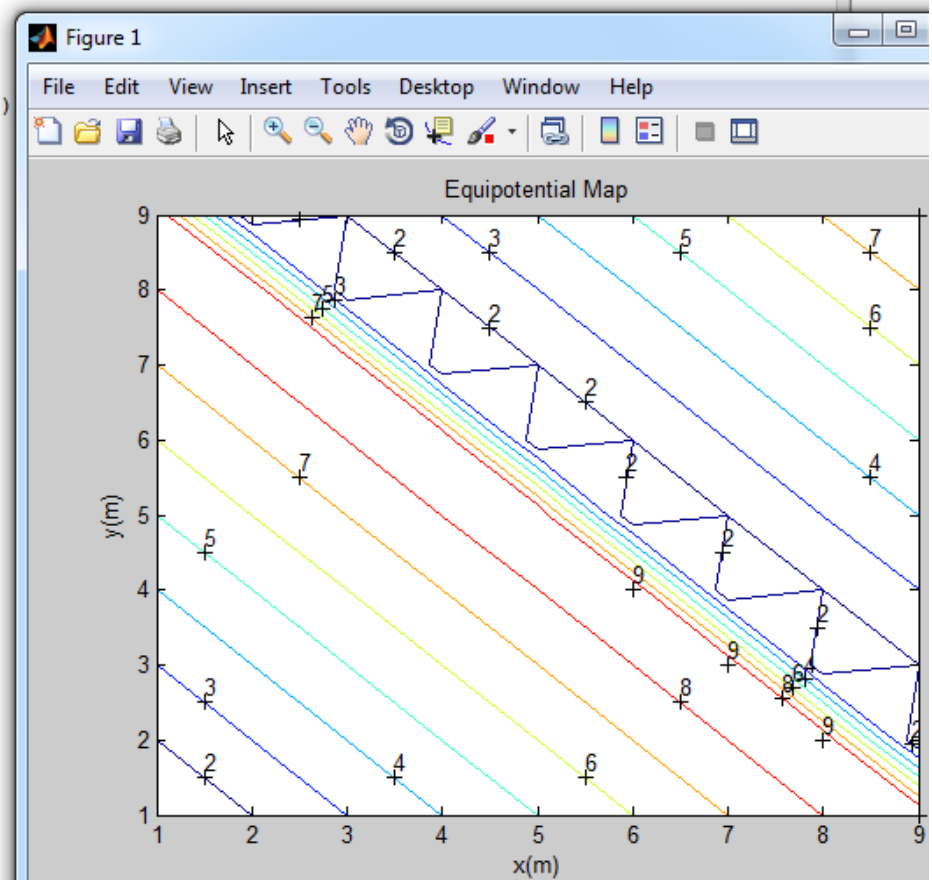


14) (2 pnts) Open up Excel and create the data table shown at right. Save the file as a comma delimited file (CSV). Upload the file to MATLAB and create a contour plot. Show the plot to your instructor when you are done. *Alternatively,* you may cut and paste the data into MATLAB then make the contour plot.

0	0	0	0	0
0	1	1	1	0
0	1	2	1	0
0	1	1	1	0
0	0	0	0	0

Note: in case you've forgotten, I'm including the MATLAB screen shot below. This screen shot will NOT be available on the test day. Do note: the helpfile is always available but it may eat up some time. If you are having trouble getting it to work, consider trying the helpfile. Also, only the first three lines of code are needed as on the lab exam I will not be concerned about formatting. If you have trouble identifying the filepath, find the file wherever you saved it, right click on it, and hit "properties". This will help you find your filepath which will be different than mine in the screenshot shown below.

```
    This is a Classroom License for instructional use only.
    Research and commercial use is prohibited.
>> filename='C:\Users\Lab-User\Desktop\FieldMapTestData.csv';
>> M=csvread(filename);
>> contour(M);
>> clabel(contour(M));
>> title('Equipotential Map')
>> xlabel('x(m)')
>> ylabel('y(m)')
>>
```



15) (2pnts) A function is given as

$$x = ae^{-bt^2} - b\sin\left(\frac{t}{a}\right)$$

Use an Excel function to generate the values for x in the table shown at right. I expect you to properly reference the constants a and b. I will come over and change the values of a and b to verify your formula is properly referencing the constants.

	A	B
1	a	b
2	2	3
3		
4	t	x
5	0	
6	0.1	
7	0.2	
8	0.3	
9	0.4	
10	0.5	
11	0.6	
12	0.7	
13	0.8	
14	0.9	
15	1	

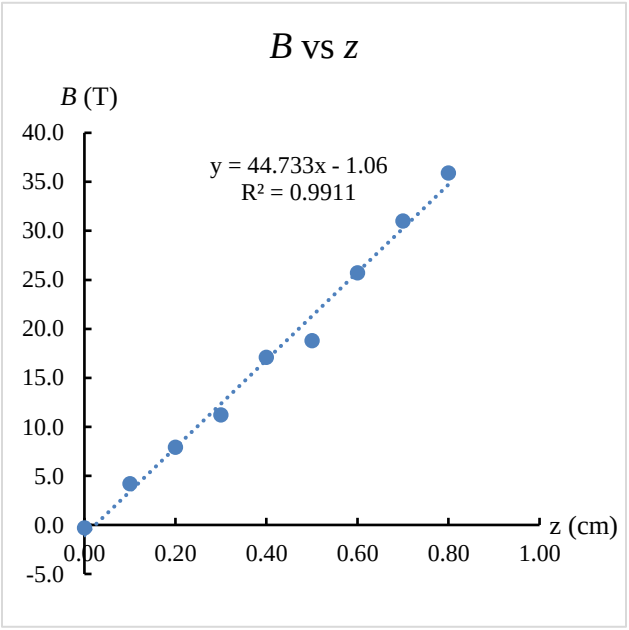
Note: do not worry about sig figs or formatting. To reference the constants you can use A2 for a and B2 for b. In cell B5 you would type the following:

=A2*exp(-b2*a5^2)-B2*sin(a5/a2)

Notice that capitalization is unimportant and Excel properly uses order of operations. Finally, mouse over the black square in the corner, click on it and practice filling down the equations. Check a random row with your calculator to ensure it is working. Lastly, try changing a and b to see if cells b5 through b15 auto-update.

16) (2 pnts) A student collects data and makes the data table and plot shown. Furthermore, you are told the data is supposed to obey the equation

$$\frac{z}{Bc^2} = \frac{kI}{a}$$



Determine the constant k from the trendline. If you determine k point by point from the data and average it you will receive no points.

On exam day I expect you to have the following procedure memorized:

i. First rearrange the equation in the form
ii. $B = slope \cdot z$
iii. Then write down an equation that relates the slope to the parameters a, c, y, and I.
iv. Solve that equation for y.
v. Plug in the values of I, a, and c from the table. Be sure to include the units.
vi. Plug in the number for the slope (with units) from the trendline. Remember that the units of the slope are units of rise over units of run.

I (mA)	a (cm)	c (s)
0.50	4.0	3.0

z (cm)	B (T)
0.00	-0.3
0.10	4.2
0.20	7.9
0.30	11.2
0.40	17.1
0.50	18.8
0.60	25.7
0.70	31.0
0.80	35.9

Answer: $k = \frac{a}{slope \cdot Ic^2} = 0.001\underline{9}87 \frac{\text{m}^2}{\text{T·A·s}^2}$

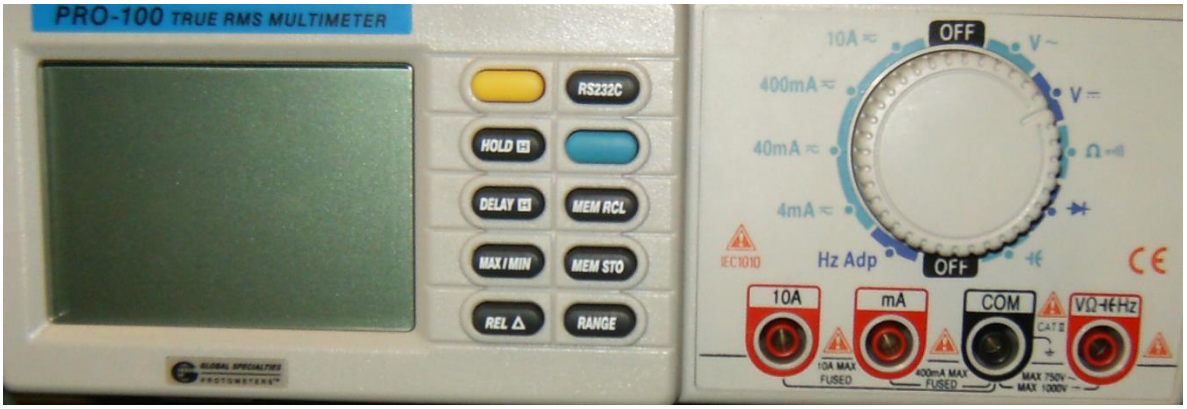
17) (2 pnts) A student collects the data shown at right. Use the data to make a plot of I vs z. Put a linear trendline on the plot displaying both the equation of the trendline and the R^2 value. Write down the equation of the trendline on this paper and show it to your instructor. Determine the slope of the trendline with units. Determine the intercept of the graph with units.

z (cm)	I (mA)
0.000	254
0.100	228
0.200	189
0.300	156
0.400	133
0.500	108

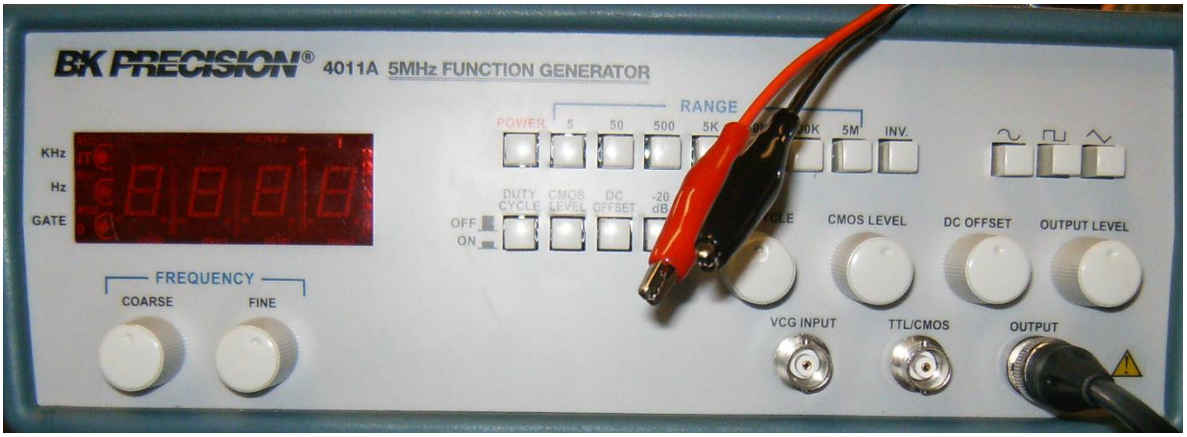
Tips: Watch out for the units! Remember that the units of the slope are units of rise over units of run. The units of intercept are the same as the units of the y-axis. For I vs z, I should be on the y-axis and z on the x-axis. For this set, it might make sense to convert cm to m and mA to A when writing down the final units of slope. Finally, notice the numbers in the table all have 3 sig figs. If you write down numbers from the trendline, indicate they should have three figs. Answer for slope: $slope = -29\underline{9}.43 \frac{\text{mA}}{\text{cm}} = 29.9 \frac{\text{A}}{\text{m}}$.

Picture of Wavetek DMM

Picture of Benchtop DMM



Picture of Function Generator



Picture of Scope