Partial list of topics that may be covered on the 163 lab practical:

Note: topics below marked with * may *not* be on exam (ask your instructor). Expect ½ of the items in bold plus a few other things.

Measure the voltage of a battery with a DMM.

Measure current in a single element circuit even if the circuit elements are wired in parallel.

Properly connect a series or parallel circuit (with resistors and breadboards OR light bulbs and cables).

Properly connect a circuit that includes combinations of series and parallel elements.

Properly measure resistance or voltage across any resistor/bulb in any of the above circuits. Remember to remove *R* from circuit before you measure it!

Properly connect an *LRC* series circuit to a function generator operating at a frequency specified by your instructor.

Properly measure a pk-pk voltage, pk voltage, or rms voltage with an oscilloscope. <u>You must be able to do this by counting the boxes on the screen as well as using the MEASURE button!</u>

May need to divide a voltage measurement by *R* to convert it to a current measurement (*i. e.* $i_{max} = \frac{V_{peak}}{R}$).

Properly measure the frequency, period, or amplitude of a sine wave (output from a function generator) with an oscilloscope. <u>You must be able to do this by counting the boxes on the screen!</u> Recall $\frac{\text{Volts}}{\text{div}}$ & $\frac{\text{sec}}{\text{div}}$ appear somewhere on the screen…

Understand what it means to "float" the scope and in what circumstances it is useful/appropriate.

Properly set-up a four-probe measurement of resistance (see the Ohm's law and resistivity lab).

Know how to use all measuring devices this semester. For example, know what settings/cables/inputs to use for a DMM to measure current/voltage/resistance. Similar for oscilloscopes, function generators, LCR meters, and other major pieces of equipment.

Know how to use both benchtop and handheld DMMs.

Know how to use all the power sources we used this semester (what knobs to turn and what buttons to push).

*Determine the capacitance or resistance in an *RC* transient circuit using either a stopwatch and DMM or an oscilloscope.

Possible Computational Tasks (at least one is guaranteed on each exam version):

Save a data file in Excel as a CSV file, upload to MATLAB, and make a contour plot.

Make a data table in Excel requiring the use of functions with constants.

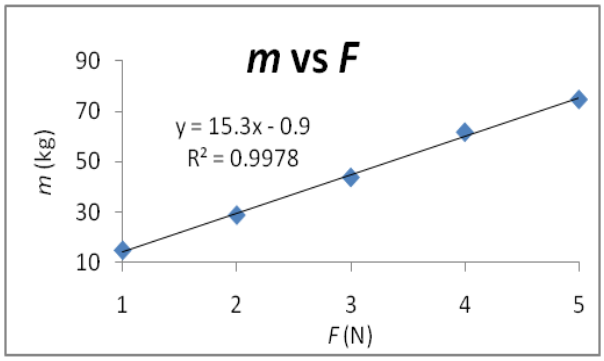
Make an *xy*-scatter plot for a given set of data in Excel.

For a given plot fit a trendline in Excel.

Use an equation to generate a table of theoretical data using functions and constants.

Use a trendline, knowledge of the *xy*-axes, and an algebraic equation relating the axes to determine a desired quantity. To clarify this complex task here is an example:

1) You know (or are told) that $F=ma$.
2) You are shown the graph at right.
3) You notice that the *y*-axis is *m* while the *x*-axis says *F*. This means you need to solve your algebraic equation for *m* instead of *F* if you want it to match the equation of a line *y=slope·x+intercept*.
   Therefore you write the equation as $m = \frac{1}{a}F$.
4) Comparing your equation with the trendline of the form *y=slope·x+intercept* you notice that *F* is like the *x*-variable and therefore the slope must be $1/a$.
5) You notice the slope of the trendline is the number 15.3 with units of *y*-axis over units of *x*-axis. This implies:



$$\frac{1}{a} = 15.3\frac{\text{kg}}{\text{N}} = 15.3\frac{\text{kg}}{\frac{\text{kg}\cdot\text{m}}{\text{s}^2}} = 15.3\frac{\text{kg}\cdot\text{s}^2}{\text{kg}\cdot\text{m}} = 15.3\frac{\text{s}^2}{\text{m}}$$

$$a = \frac{1}{15.3\frac{\text{s}^2}{\text{m}}} = \frac{1}{15.3}\frac{\text{m}}{\text{s}^2} = 0.0654\frac{\text{m}}{\text{s}^2}$$

- **Expect about 8 tasks in about 35 minutes (plus 5 min passing). Some are easy, a few medium, and at least one is hard.**
- **The final score (out of 11) is scaled to be equivalent to 2-3 lab write-up scores…a decent chunk of points.**
- **For some questions you show the equipment while you measure; for others you write down an answer.**
- **No extra time is allowed for the lab practical. If you are in LAP, discuss options with me ASAP.**