Introduction  
  
 In lecture we have discussed many topics relating to fields, electric potential, and capacitance. We learned that capacitors are required to mediate and store charges in almost all modern day electronics. They do this by separating charged metal plates with a non-conductive dielectric material in order to maintain a low operating voltage, and a high capacitance. The goal of this lab is to use knowledge from the lecture and spreadsheet technology to experimentally determine the dielectric constant of textbook pages. We used a capacitance meter, digital caliper, a physics textbook, and some aluminium foil to experimentally determine the capacitance of the textbook, as well as its dielectric constant to within units.

Experimental Method

First, cut out rectangular aluminium sheets that match (but may be slightly smaller) than the area of a textbook page. Measure the dimensions of the two 'plates', ensuring they are similar in size. The smallest area plate will be the one important in your calculations, as it will limit the capacitance of the system (ideally the plates should be very close in size). When inserting these 'plates' into the textbook, it is important to ensure that there is *no overhang* from the sides of the textbook. If this is the case, measurements will record less of the dielectric constant of paper, and more of the dielectric constant of open air. Measure the thickness of the pages between the plates of the capacitor using the electronic caliper to determine the distance between plates. In these trials, you should record distances at regularly spaced intervals for the purposes of graphing later on. Once the thickness of paper has been recorded, connect the electrodes of the capacitance meter to the top and bottom plate. It does not matter which side (positive or negative) is attached to which plate. It may be useful to clip the electrodes onto free pieces of aluminium foil and place those in contact with the capacitor plates so as to not tear the plates themselves (alligator clips can be very damaging to light foil). Measure the capacitance of the system by turning on the capacitance meter, and adjusting it until an accurate reading is displayed. The meter can measure a wide range of capacitances, so it is best to start at a large value and gradually reduce the knob until the most accurate reading can be obtained. Once the capacitance has been recorded, conduct similar trials at varying thickness' (changing the distance between the plates, and the capacitance of the system). This data may then be exported to excel - some unit conversions may be necessary (from pico Farads to Farads, and milimeters to meters). In the graphical representation, constants in the capacitance equation (such as may be ignored (they will be used later to determine the accurate experimental *k* value). Plot capacitance (F) as a function of distance between plates (1/m) so that the slope of this graph will be the product of the two Once plotted, insert a trendline or line of best fit to examine the slope. The value of the slope, divided by A will equal the dielectric constant of the paper.

Results

In the experiment outlined above, the capacitance of the textbook was determined to be using the error propagation method outlined in the Physics 126 Laboratory Manual:

d= 0.m C= A= 0.0564m2