ECE 441 (Spring 2009) HW #4
Due: **Friday, February** 20^{th}**, 2009**

1. Muller & Kamins 4.9.

2. Muller & Kamins 4.11.

7.5 The data from a measurement of the small-signal capacitance of a silicon p^+-n diode structure as a function of bias voltage is plotted in the form $1/C_{dp}^2$ versus V_{AB} in Fig. P7.5. The area of the junction is 10^{-3} cm^2. Use this data to answer the following questions about the device.

(*a*) What is the built-in potential of this junction?

(*b*) What is the doping level of the more lightly doped side (n-side) of this diode in the vicinity of the junction? Note that in a p^+-n junction, $N_{Ap} >> N_{Dn}$ and we can write $N_{Ap}N_{Dn}/(N_{Ap} + N_{Dn}) \cong N_{Dn}$, so Eq. (7.19a) can be simplified somewhat.

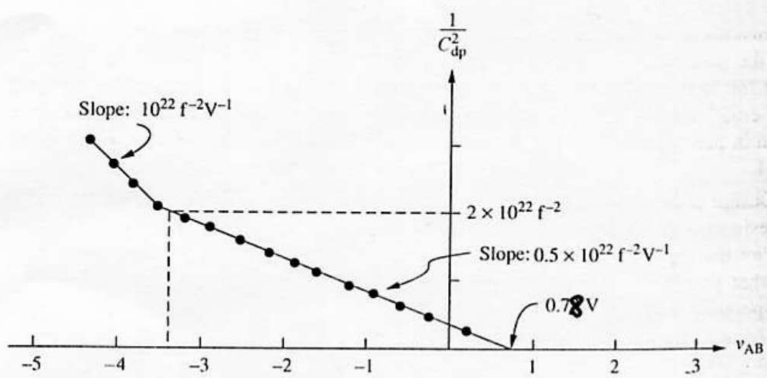

FIGURE P7.5

(*c*) What is the doping level of the more heavily doped side? *Hint*: Use your knowledge of ϕ_o and N_{Dn}.

(*d*) At some distance from the junction the doping level changes.
  (i) At what distance from the junction does the change occur?
  (ii) Does the doping level increase or decrease at this point, and what does it become?

(*e*) Suppose that in addition to the above structure there is a very heavily doped n^+-region 3 μm from junction. How would you expect the plot of $1/C_d^2$ versus V_{AB} to look in this case? Sketch and explain your answer.