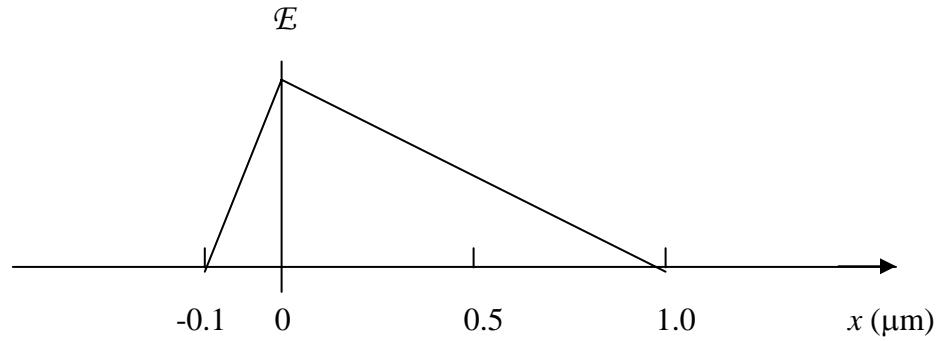


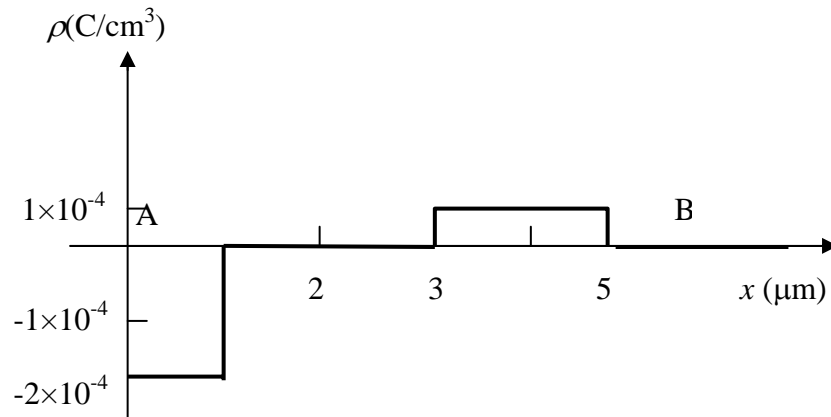
**ECSE-2210 Microelectronics Technology**  
**Fall 2005**  
**Class Activity 12**

1. Shown below is the electric field profile in the depletion region of a semiconductor p-n junction in thermal equilibrium. Answer the following questions with explanations.



- (a) Which side is p-type and which side is n-type? Write down Poisson's equation and obtain the answers from this equation.
- (b) Is the n-type region uniformly doped within the depletion layer? Is the p-type region uniformly doped? Explain.
- (c) Which side is more heavily doped?
- (d) If the p-type region has a net doping concentration of  $10^{15} \text{ cm}^{-3}$ , what will be the doping concentration in the n-type region?

2. The figure below shows the space charge density in Si as a function of  $x$  under applied bias. Assume  $\epsilon_{\text{Si}} = 10^{-12}$  F/cm in your calculations.



- (a) Calculate and plot the electric field as a function of distance assuming  $\mathcal{E} = 0$  at  $x = 0$ .
- (b) What is the electrostatic potential difference between A and B? [i.e., what is  $V(B) - V(A)$ ]?
- (c) Determine the doping concentration at  $x = 0.5$  μm,  $x = 2$  μm and at  $x = 4$  μm.