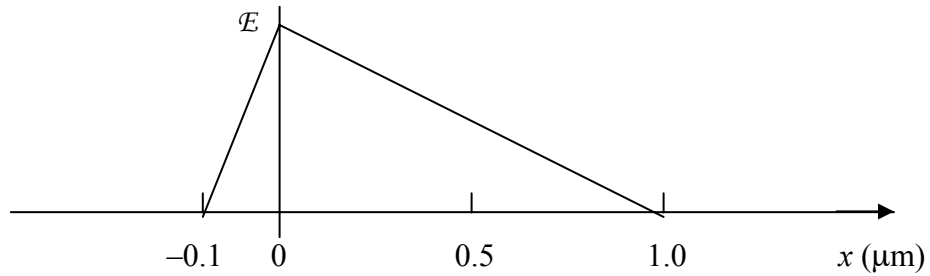


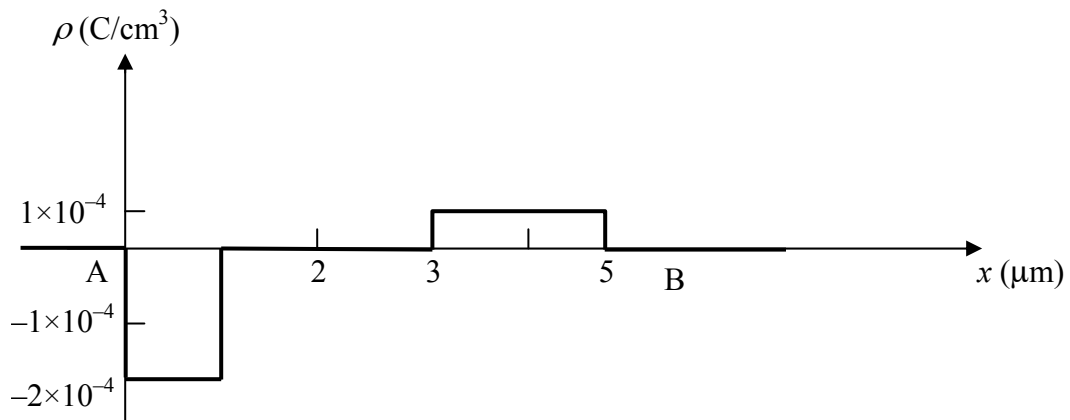
ECSE-2210 Microelectronics Technology
Class Activity 12

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} cm^{-3} , what will be the doping concentration in the n-type region?

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 $x = 0.5 \mu\text{m}$, $x = 2 \mu\text{m}$ and at $x = 4 \mu\text{m}$.