Week 6 Quiz: Device Fabrication and PN Diodes I  
ECE 305: Semiconductor Devices  
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Answer the multiple choice questions below by choosing the one, best answer.

1) Ion implantation is a technique to do what?  
   a) Dope a semiconductor.  
   b) Deposit an insulating layer on a semiconductor.  
   c) Deposit a metallic layer on a semiconductor.  
   d) Deposit an insulating layer on an insulator.  
   e) Deposit a metallic layer on an insulator.

2) What is “lithography” used for in semiconductor manufacturing?  
   a) To dope semiconductors.  
   b) To deposit amorphous films on semiconductors.  
   c) To deposit polycrystalline films on semiconductors.  
   d) To grow crystalline films on semiconductors.  
   e) To produce patterns in the films deposited on semiconductors.

3) What is the most common insulator used in silicon manufacturing?  
   a) Si3N4.  
   b) Al2O3.  
   c) SiO2.  
   d) HfO2.  
   e) Ta2O5.

4) Which of the following statements is true about the magnitude of the electric field in the transition region of an NP junction?  
   a) It is constant in space.  
   b) It increases linearly from the N side to the P-side.  
   c) It decreases linearly from the N side to the P-side.  
   d) It first increases linearly, reaches a peak at the junction, then decreases linearly.  
   e) It increases quadratically from the N side to the P-side.

5) Which of the following is true about the electron density in the transition region $-x_n < x < x_p$ of an NP junction?  
   a) It is less than $n_i$ everywhere.  
   b) It is zero everywhere.  
   c) It is much less than the doping density over most of the transition region.  
   d) It varies with space as $\exp(-x / L_n)$ .  
   e) It varies with space as $\cosh(x / L_n)$.
6) The built-in potential of an NP junction is roughly equal to what in magnitude?

   a) The thermal voltage, $k_B T / q$.
   b) $3k_B T / 2q$.
   c) 110 V.
   d) The bandgap of the semiconductor in eV.
   e) The electron affinity of the semiconductor in eV.

7) What happens if we insert an intrinsic (undoped) layer between the N and P layers of an NP junction?

   a) The built-in potential decreases by about a factor of 2.
   b) The built-in potential increases by about a factor of 2.
   c) The built-in potential becomes zero.
   d) The built-in potential becomes $k_B T / q$.
   e) The built-in potential does not change.