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**Week 9 Quiz ANSWERS: MS Diodes**  
**ECE 305: Semiconductor Devices**  
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(corrected 3/20/15)

Answer the **multiple choice questions** below by choosing the **one, best answer**.

- 1) Which of the following is the workfunction?
  - a) The energy required to move an electron from  $E_C$  to the vacuum level.
  - b) The energy required to move an electron from  $E_i$  to the vacuum level.
  - c) The energy required to move an electron from  $E_V$  to the vacuum level.
  - d) The energy required to move an electron from  $E_F$  to the vacuum level.**
  - e) The energy required to move an electron from  $E_F$  to  $E_C$ .
  
- 2) Which of the following is the electron affinity?
  - a) The energy required to move an electron from  $E_C$  to the vacuum level.**
  - b) The energy required to move an electron from  $E_i$  to the vacuum level.
  - c) The energy required to move an electron from  $E_V$  to the vacuum level.
  - d) The energy required to move an electron from  $E_F$  to the vacuum level.
  - e) The energy required to move an electron from  $E_F$  to  $E_C$ .
  
- 3) Which of the following is the Schottky barrier height?
  - a) The difference between the conduction band at the MS junction of an N-type semiconductor and the Fermi level in the metal.
  - b) The difference between the valence band at the MS junction of an N-type semiconductor and the Fermi level in the metal.
  - c) The difference between the conduction band at the MS junction of a P-type semiconductor and the Fermi level in the metal.
  - d) The difference between the valence band at the MS junction of a P-type semiconductor and the Fermi level in the metal.
  - e) a) and d).**
  
- 4) The bandbending in the semiconductor is equal to what?
  - a) The Schottky barrier height .
  - b) The semiconductor electron affinity.
  - c) The semiconductor workfunction.
  - d) The metal workfunction.
  - e) The built-in potential of the MS diode.**

- 5) Where does the peak electric field occur in an MS junction?
- Deep inside the metal.
  - Deep inside the semiconductor.
  - At the edge of the semiconductor transition region.
  - At the metal-semiconductor interface.**
  - About one Debye length from the metal-semiconductor interface.
- 6) The forward-biased current in an MS diode can be written as  $I_D = I_0 e^{qV_A/nk_B T}$ , where  $n$  is the diode ideality factor. What is the value of the diode ideality factor?
- $n = 0.5$
  - $n = 1$**
  - $n = 1.5$
  - $n = 1$  at mid forward bias and  $n = 2$  at low forward bias.
  - $n = 2$  at mid forward bias and  $n = 1$  at low forward bias.
- 7) What is the consequence of the fact that MS diodes are majority carrier devices, not minority carrier devices like NP diodes?
- The barrier height is smaller than the bandgap.
  - The small signal model does not have a diffusion capacitance.**
  - The small signal model does not have a junction capacitance.
  - The diode turn on voltage is smaller.
  - The series resistance is smaller.