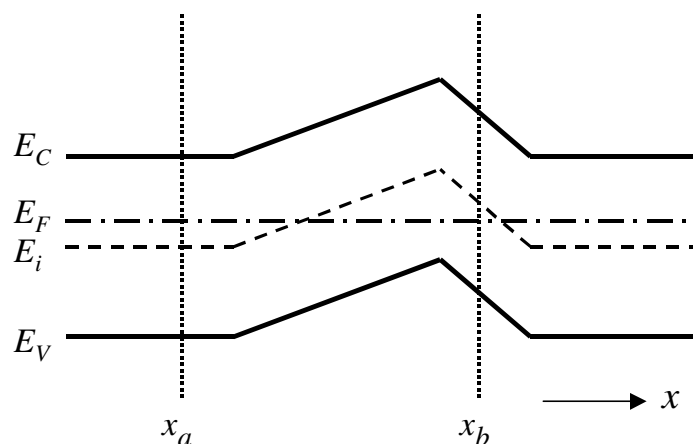


Test for Semiconductor Device Theory

(Abacus)

This test is examining students' basic preparedness in solid state electronics and semiconductor devices.

1. The number of nearest neighbors and next nearest neighbors for simple cubic lattice is:
 - (a) 6 and 12
 - (b) 12 and 8
 - (c) 4 and 6
2. The number of nearest neighbors and next nearest neighbors for face centered cubic lattice is:
 - (a) 12 and 6
 - (b) 8 and 12
 - (c) 6 and 12
3. The number of nearest neighbors and next nearest neighbors for body centered cubic lattice is:
 - (a) 12 and 6
 - (b) 8 and 12
 - (c) 8 and 6
4. Consider the following energy band diagram and answer the following questions:



The drift current at $x=x_b$ is:

- (a) Zero
- (b) Negative
- (c) Positive

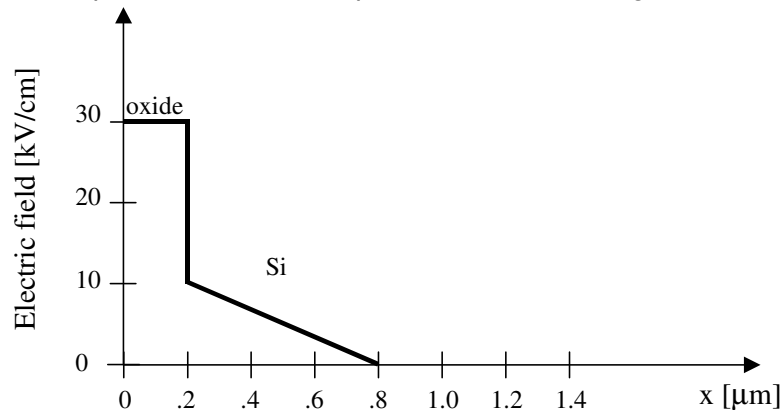
The diffusion current at $x=x_a$ is:

- (a) Zero
- (b) Negative
- (c) Positive

The total current at $x=x_a$ and $x=x_b$ is:

- (a) Zero
- (b) Negative
- (c) Positive

5. In a PN diode, the increase in doping concentration on one side of the junction leads to:
- (a) Smaller depletion region width
 - (b) Larger depletion region width
 - (c) Identically the same depletion region width
6. In a PN diode, the increase in doping concentration on one side of the junction leads to:
- (a) Larger peak electric field
 - (b) Smaller peak electric field
 - (c) Identically the same value for the electric field
7. Consider the MOS Capacitor Electric field profile shown in the figure below:



The electric field in the oxide is constant and the electrostatic potential is:

- (a) Constant
- (b) Varying linearly with distance
- (c) Varying quadratically with distance

The electric field in the semiconductor is varying linearly and the electrostatic potential is:

- (a) Varying linearly
- (b) Varying quadratically
- (c) Varying cubically with distance.

Based on the electric field profile, can you specify whether the MOS capacitor is biased in the:

- (a) Accumulation mode of operation
- (b) Depletion mode of operation
- (c) Inversion mode of operation

8. MOSFETs as of today are:

- (a) Enhancement mode devices
- (b) Depletion mode devices
- (c) None of the above

9. Quantum size effects:

- (a) Are important in today's MOSFET's device operation.
- (b) They are irrelevant for MOSFET's device operation.
- (c) None of the above

10. MESFETs as of today are:

- (a) Enhancement mode devices
- (b) Depletion mode devices
- (c) None of the above