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Courses » Fundamentals of semiconductor devices

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Unit 5 - p-n junction

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Course outline

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- Quiz : Week 4 - Assignment
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- p-n junction under equilibrium (contd.)
- p-n junction under bias
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- p-n junction: generation-recombination currents

Week 4 - Assignment

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment. **Due on 2019-02-27, 23:59 IST.**1) Calculate the built-in potential for a Silicon P-N junction with $N_D=10^{16}/\text{cm}^3$ **1 point** and $N_A = 10^{19}/\text{cm}^3$ at 300 K. Assume $n_i = 10^{10}/\text{cm}^3$

- 0.9 V
- 2 V
- 0.05 V
- 1.5 V

No, the answer is incorrect.**Score: 0****Accepted Answers:**

0.9 V

2) Calculate the depletion width of a Silicon P-N junction with $N_D=10^{16}/\text{cm}^3$ **2 points** and $N_A = 10^{18}/\text{cm}^3$ at 300 K. Assume $n_i = 10^{10} \text{ cm}^{-3}$, $\epsilon_s = \epsilon_0 \times \epsilon_{\text{Si}} = 8.854 \times 10^{-14} \text{ F/cm}$ x 11.7.

- $3.2 \times 10^{-5} \text{ cm}$
- $5.2 \times 10^{-7} \text{ cm}$
- $7.2 \times 10^{-3} \text{ cm}$
- $1.2 \times 10^{-2} \text{ cm}$

No, the answer is incorrect.**Score: 0****Accepted Answers:** $3.2 \times 10^{-5} \text{ cm}$ 3) Calculate the maximum electric field at zero bias for question no. 2 **1 point**

- $15 \times 10^6 \text{ V/cm}$
- $5 \times 10^6 \text{ V/cm}$

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Bipolar Junction Transistor	ce De	$5 \times 10^4 \text{ V/cm}$
Metal Oxide Semiconductor Capacitor		
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Applications of transistors and basics of microelectronic fabrication		

4) Calculate the donor atom concentration (N_D) in a Silicon P-N junction to get a **1 point** built-in potential of 0.77 V, with $N_A = 10^{18}/\text{cm}^3$ at 300 K. Assume $n_i = 10^{10}/\text{cm}^3$

$10^{19}/\text{cm}^3$
 $10^{18}/\text{cm}^3$
 $10^{15}/\text{cm}^3$
 $10^{20}/\text{cm}^3$

No, the answer is incorrect.
Score: 0
Accepted Answers:
 $10^{15}/\text{cm}^3$

5) For a GaAs P+-N diode and a GaN N+-P diode (P+ indicates heavy P doping **1 point** and N+ indicates heavy N doping, neglect heavy doping effects), which of the following statements is true.

Depletion region has greater width in N region for GaAs diode while depletion region has greater width in P region in GaN diode.
 Depletion region has greater width in P+ region for GaAs diode while depletion region has greater width in P region in GaN diode.
 Depletion region has greater width in N region for GaAs diode while depletion region has greater width in N+ region in GaN diode.
 Depletion region has greater width in N+ region for GaAs diode while depletion region has greater width in P+ region in GaN diode.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Depletion region has greater width in N region for GaAs diode while depletion region has greater width in P region in GaN diode.

6) Consider an ideal PN junction diode with cross-section dimension of 10 μm X **1 point** 10 μm . The reverse-saturation current density is 0.1A/m². At a forward bias voltage of 0.5V across the diode, the forward current flowing through the diode is (Assume thermal energy is 25meV and ignore recombination and generation effects)

4.85 mA
 4.8 A
 9.7 mA
 19.4 mA

No, the answer is incorrect.
Score: 0
Accepted Answers:
 4.85 mA

7) Consider diodes made of four different materials, namely, Gallium Nitride, **1 point** Gallium Arsenide, Silicon and Germanium. If there is a requirement of a switch which has good off-state characteristics i.e. it should have very low off state current (Reverse biased diode can act as switch in off-state), diode made of which material satisfies this requirement better

Gallium Arsenide
 Germanium

- Silicon
- Gallium Nitride

No, the answer is incorrect.

Score: 0

Accepted Answers:

Gallium Nitride

8) Consider diodes made of four different materials, namely, Gallium Nitride, Gallium Arsenide, Silicon and Germanium. If there is a requirement of a switch which has good on-state characteristics i.e. it should have very low on state voltage drop (Forward biased diode can act as switch in on-state), diode made of which material satisfies this requirement better? **1 point**

- Gallium Arsenide
- Germanium
- Silicon
- Gallium nitride

No, the answer is incorrect.

Score: 0

Accepted Answers:

Germanium

9) Consider a semiconductor material in which electrons and holes have the same capture cross sections and thermal velocities. A p-n junction is formed using this material and all the trap levels in the depletion region lie at the mid-gap. As the doping of P and N sides of the junction is reduced (but is still much greater than intrinsic concentration), the generation current under reverse bias. **1 point**

- Increases
- Decreases
- Remains same
- Needs more information

No, the answer is incorrect.

Score: 0

Accepted Answers:

Increases

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