

Name: KEY

Id#

COE 360, Principles of VLSI Design, Term 032
Quiz# 1

Date: Sunday, Feb. 29, 2004

Q1. Fill in the blank:

- (1) **Drift current** is the motion of charges due to the application of an electric field.
- (2) **Diffusion current** is the motion of charges resulting from a non-uniform charge distribution.
- (3) The current per unit area in a conducting medium is called the **current density**.
- (4) The conductivity of a material increases with the increase in the **charge carrier concentration** and the **mobility of charge carriers**.
- (5) The applied voltage across a conductor increases with the increase in the **electric field** and the **length of the conductor**.
- (6) The resistance of a conductor increases with the increase in **length** and the decrease in **area** and **conductivity**.
- (7) A silicon atom has **14** electrons, **4** of which are valence electrons.
- (8) At T=0K, all the valence electrons in a silicon semiconductor are in the **valence** band.

- (9) **Intrinsic** Semiconductors are pure crystals that contain no foreign atoms or impurities
- (10) **Fermi** energy is the energy level below which all the energy states are filled with electrons and above which all the states are empty at $T=0K$.
- (11) In an intrinsic semiconductor, at a given temperature, the concentration of free electrons is **equal to** the concentration of free holes.
- (12) The addition of trivalent atoms to an intrinsic semiconductor results in a **p-type** material, while the addition of pentavalent atoms to an intrinsic semiconductor results in a **n-type**.
- (13) The majority charge carriers in a n-type material are **electrons** while the minority charge carriers are **holes**.
- (14) The mass action law states that under thermal equilibrium, the concentration of free electrons times the concentration of free holes is constant and is equal to n_i^2
- (15) If an intrinsic semiconductor material is doped with p-type impurities, the number of free holes **increases** while the number of free electrons **decreases**.
- (16) The charge neutrality law states that under thermal equilibrium, the semiconductor crystal is electrically **neutral**.
- (17) The concentration of free electrons in an n-type material doped with donor concentration N_d is nearly N_d and the concentration of free holes is n_i^2/N_d