Student ID:

Marks:

Islamic University of Technology (IUT)

Organization of Islamic Cooperation (OIC)

Department of Electrical and Electronic Engineering

Mid
2-2 | 2021

Course no. : Phy 4421 Course Title : Semiconductor Devices

Class Test : 1A Date : 23-12-2021 Time : 20 Minutes Marks : 15

1. Classify compound semiconductors based on the valency (column position in periodic table) of the constituent elements. Give two examples of each class. 6

chapter 3

2. What do you understand by 'effective mass' of charge carriers in semiconductors? 3

17

$n_i p_i = n_i^2$

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3+3

3. A Si sample is doped with 6×10^{16} boron atoms/cm^3. What is the resistivity of the sample at 300 K? Mobilities of electron and holes in Si are 1350 cm^2/V-s and 480 cm^2/V-s, respectively.

$n_0 = 6\times10^{6}$

$\mu_n = 1350\ cm^2/V\text{-}s$

$\mu_p = 480\ cm^2/V\text{-}s$

$q = 1.6\times10^{-19}$ charge of electron

1.5×10^{10}

$n_0 p_0 = n_i^2$

$p_0 = \frac{n_i^2}{n_0} = \frac{(1.5\times10^{10})^2}{6\times10^{16}} = \frac{2.25\times10^{20}}{6\times10^{16}}$

$= 0.375\times10^{4}$

$= 3750.$ $\frac{\rho l}{A}$

$\sigma = q(n_0\mu_n + p_i\mu_p)$

$= 1.6\times10^{-19}(1.5\times10^{10}\times1350 + 1.5\times10^{10}\times480)$

$= 4.392\times10^{-6}$

$R = \rho\frac{l}{A} = \frac{1}{\sigma}$

Resistivity $= \frac{1}{\sigma} = \frac{1}{4.392\times10^{-6}} = 227686.7\ \Omega$