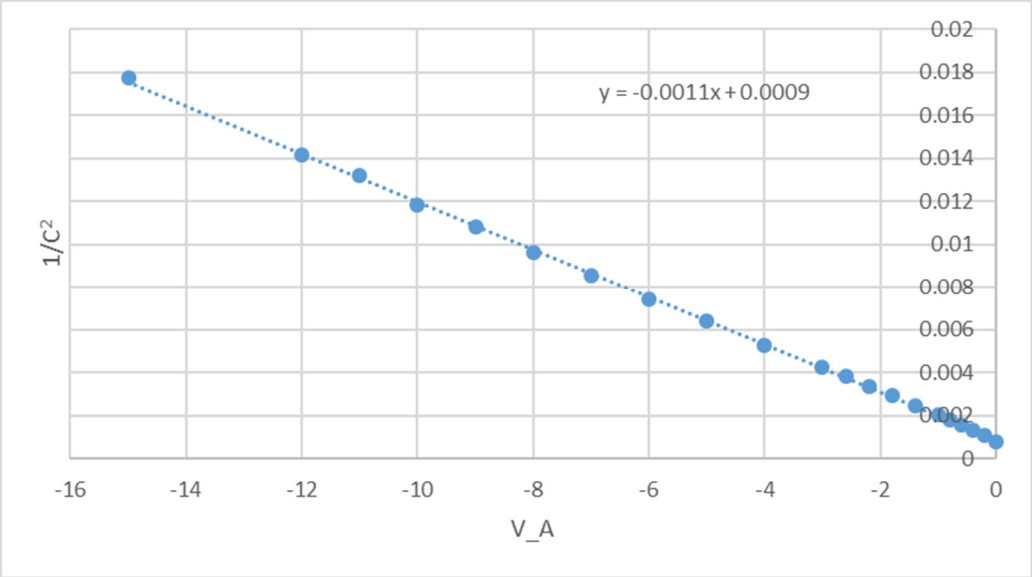
ECE 305 – Spring 2018

Homework 8 Solution

1. a.

$$\frac{1}{C_j^2} = \frac{2}{qN_D K_S \varepsilon_0 A^2}(V_{bi} + V_R) = \frac{2}{qN_D K_S \varepsilon_0 A^2}(V_{bi} - V_A)$$



x intercept: 0=$V_{bi} - V_A$ or $V_{bi} = V_A = \frac{-0.0009}{-0.0011} = 0.818\ V$

b.

Slope=$\frac{-2}{qN_D K_S \varepsilon_0 A^2}$

Slope in F^{-2} = -0.0011× 10^{24}= -1.1× 10^{21}

$N_D = \frac{-2}{qK_S \varepsilon_0 A^2 \times \text{Slope}}$

$$\varepsilon_0 = 8.854 \times 10^{-14} F/cm$$

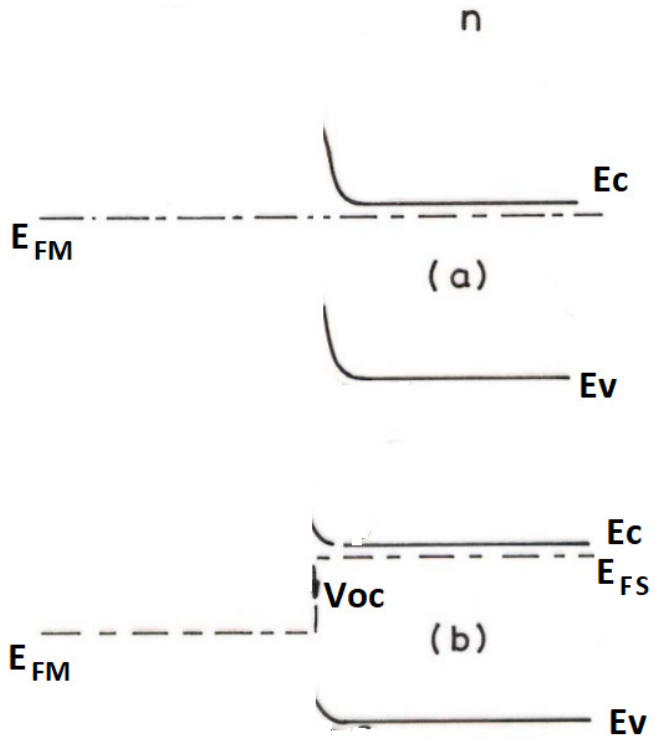
A=3× $10^{-3}\ cm^{-2}$

$K_S = 11.8$

$N_D = 1.21 \times 10^{15}\ \ cm^{-3}$

2.

a. & b.



c.

I_L=-qA (L_N+W+L_p) G_L (according to SDF Section 9.2.1), L_x being minority carrier recombination length

=-qA(W+L_p) G_L if p-side is taken as having 0 dimension.

As recombination length is not given, it is assumed that all the carriers generated in 100 µm contribute to photocurrent.

I_L=-qA(100 µm)

J_L=-q(100 µm) G_L=-q(0.01 cm) G_L=-0.04 A cm^{-2}

d.

At zero voltage the net current density is approximately equal to the photocurrent.

At Voc the net current is zero.