



Electrical Engineering Dept.
Faculty of Engineering
Assiut University
2nd Semester – Final Exam
2014/2015 - May 2015

Course: Electronics (1)
1st year – bylaw: 2004
Time: 3 Hours
Marks: 100



Number of Pages: 2 - Answer the Following 6 Questions

Question no. 1 (10 points).

Describe the theory of operation for Mass Spectrograph and how can it be used to measure the particles mass.

Question no. 2 (10 points).

What are the main differences between ohmic and Schottky contacts?

Question no. 3 (20 points).

For Step PN junction with $N_d = 10^{18} \text{ cm}^{-3}$, $N_a = 10^{16} \text{ cm}^{-3}$ using depletion approximation, draw (a) the space charge profile; (b) Electric field; (c) electric potential (d) energy band diagram. Also calculate (e) maximum electric field, (f) depletion layer width, (g) built in voltage

Question no. 4 (20 points).

Calculate the responsivity of a Silicon photodiode with 95% quantum efficiency at wavelength 670nm. What are the advantages and disadvantages of implementing photodetectors using Silicon compared to GaAs? Can Silicon be used to fabricate an efficient LED?

Question no. 5 (20 points).

- Draw the structure, I-V characteristics and write the equations of solar cell.
- A solar cell with $V_{oc}=0.6V$, $I_{sc}=200mA$, and $FF=0.8$, calculate the generated electrical power. How to construct a solar cell array with 36V

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total output voltage and 8A output current using this unit cell. Calculate its generated power.

Question no. 6 (20 points).

Drive the truth table of the logic gate in Figure 1, which diode will be ON and which will be OFF in each state? What is the name of this logic function?

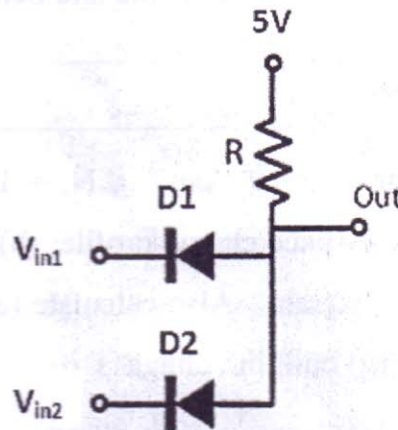


Figure 1

Useful Constants at 300 K

Vacuum permittivity = 8.85×10^{-12} F/m, Dielectric Constant = 11.9, Energy Gap $E_g = 1.12$ eV, effective Conc. of CB states $N_c = 2.86 \times 10^{19}$ cm⁻³, Effective Conc. of VB states $N_v = 3.1 \times 10^{19}$ cm⁻³, Intrinsic Carrier Conc. $n_i = 1.07 \times 10^{10}$ cm⁻³, Electron Mobility = 1600 cm².V⁻¹.s⁻¹, Hole Mobility = 430 cm².V⁻¹.s⁻¹, $K = 1.38 \times 10^{-23}$ J K⁻¹, elementary charge = 1.6×10^{-19} C, Electron effective mass $m_n = 0.26 m_o$, Hole effective mass $m_p = 0.39 m_o$, Free space electron mass $m_o = 9.11 \times 10^{-31}$ Kg.

Good Luck
Dr. Mohamed Atef

