Optoelectronics SS 2014 (16.07.2014)

1.) What is an elemental semiconductor, what is a compound semiconductor? Give an example for each type! 3 points

2.a) What is the difference in the band structure between direct and indirect semiconductor? (drawing and **short** explanation) 4 points
2.b) In which way the difference in the band structure influence the fundamental absorption edge (short explanation)? 5 points

3.) In an intrinsic semiconductor the Fermie energy is located in the middle of the energy gap at T = 0 K. How the position of Fermie energy is changed by doping with donors (T = 0 K)? What will be happened at higher temperatures? 4 points

4.) Which absorption processes can occur in semiconducting materials? 5 points

5.) What is the difference between an isojunction and a heterojunction? 2 points

6.) Draw the current-voltage-characteristic of a photodiode with and without irradiation (mark characteristic points). Normally we can operate with a photodiode in three different operation modes. Mark these operation modes in the I-V-curve. 8 points

7.) The dark current in a photodiode consists of four parts. What are these parts? 4 points

8.) Which electronic devices are necessary to operate with a normal photodiode as detector (measurement of the voltage during irradiation) in bias reversal mode? (drawing of the electronic circuit and the I-V curve with **operation** point) 7 points

9a) What is the corner frequency of a photodiode (**formula** and **equivalent electronic circuit**)? 6 points
9b) How corner frequency can be influenced (which parameter in which way)? 4 points

10.) Which advantages and which disadvantages does a photoresistor have as a detector? (four facts) 4 points

11.) Mention the essential components of an avalanche photodiode (APD)! Which function(s) do these parts have? 7 points