Homework (2)

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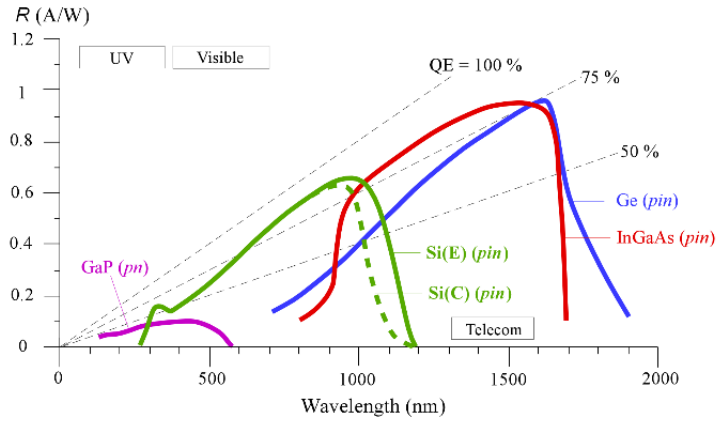
1) Consider the commercial InGaAs, Ge, Si (Enhanced and Conventional) pin photodiodes. The responsivity curves are given in the figure below.




a) For each photodiode, find the optical power at 1550 nm that will give a photocurrent of 10 nA. Comment on the answers.
b) What would be the QE for each photodiode in part (a)? Comment on the answers.
c) For each photodiode, for the same optical power in part (a), find the photocurrent at 1064 nm.
d) Plot the QE of the InGaAs pin photodiode versus wavelength. Comment on the figure.

2) Zinc oxide is an attractive material because it luminesces through the visible and UV and is relatively easy to work with as far as fabrication is concerned. Zinc oxide is relatively cheaper than other semiconductors and it is possible to grow thick substrates with low defect density.

Prepare a short report regarding the material properties of zinc oxide and its utilization in the photonics technology. Specifically, search for the following items.

- Material properties, including (but not limited to) crystal structure, bandgap energy, band structure and refractive index curve in the optical range.
- Main pros and cons of this material from optoelectronics technology prospective.
- N-type and P-type doping possibilities.
- Zinc oxide-based PN junction properties.
- Some applications in UV and visible light sources.

3) The emission spectrum for an AlGaAs IR LED is given in the figure below for three different temperatures. Verify the peak wavelength and spectral linewidth vs. *T* relations for this case.