Tutorial questions – Lectures 21-25 & 28

1. Which three parameters determine the built-in potential of a –pn-junction?
2. Explain the origin of the onset voltage for conduction in Shockley's diode equation.
3. Explain the difference between a MOS-FET and a J-FET.
4. Explain the difference in current behaviour of BJT and MOS-FET.
5. Explain the origin of the three telecommunication windows at wavelengths of ~0.85, 1.3 and 1.55μm.
6. Explain the formula for the generation rate for electron-hole pairs in a photodetector.
7. Explain how a full-frame CCD operates.
8. Discuss the pros and cons of different CCD types: full frame vs. frame transfer vs. interline.
9. Explain the two basic physical principles every LASER relies on.
10. Why do you need population inversion for stimulated emission?
11. Discuss the forms of the densities of states for bulk, thins films, nanowires and quantum dots.
12. How would you define a quantum dot?
13. Discuss the influence of the quantum well width on emission wavelength.
14. Compare qualitatively the difference between quantum confinement in an infinitely deep well and for finite well depth.
15. Explain the difference between MBE and CVD growth of thin layer materials.
16. Discuss doping by ion implantation vs. doping by adding gases to the gas flow in CVD.
17. Why is there a maximal efficiency for a single-junction solar cell (of ~32%)?
18. Explain which material is deposited on top of which and why in multi-junction solar cells, considering the wavelength dependence of the penetration of electromagnetic radiation in matter.