Tutorial Sheet – Lectures 26-27

Quantum Mechanics and Density of States

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1) Review all applications of Schroedinger's equations given in the notes.

2) For an InP/InGaAs quantum well (well width = 10nm and V_{CB} = 0.24 eV, m_e^*=0.04m_0, m_h^*=0.45m_0, and V_{VB} = 0.36 eV).

   a. Calculate the energy of the first electron bound state in the case of an infinite and finite quantum well.
   b. For the same quantum well, using the infinite well approximation, calculate the confinement energy for the first heavy hole state.
   c. What is the band-offset for this material system?
   d. Why is the band-offset important in engineering a device?
   e. Describe how the absorption energy can be calculated from a) and b). What information is missing?

3) Comment on the effect of quantum confinement upon excitonic effects.

4) How would one go about modifying the band-structure of a quantum well laser to enhance gain per unit carrier and reduce threshold current density?