

Physics of Semiconducting Materials and Devices

Bulk semiconductors. Band structure, Direct-Indirect energy gap. Dispersion relations and effective mass. Excitons. Density of States and carrier concentration. Intrinsic Fermi level. Extrinsic semiconductors and Fermi level. Majority and minority carriers. Fermi level of inhomogeneous systems and built-in potential.

Transport properties. Continuity equation. p-n junction and I-V curves. Diode capacitance. Dynamical behavior. Metal-semiconductor junction. Schottky junction. I-V characteristics. Ohmic junctions. MOS structures. Ideal MOS diode, Real MOS diode, I-V curves. Properties of the inversion threshold voltage.

Low dimensional structures, characteristic size and quantities. Energy band alignment and quantum well construction. Tetragonal QW, trigonal QW, parabolic QW. Density of States of QWs. Continuous spectrum of QWs and transport properties. Reflection-transmission matrices. Interaction of QWs. Superlattices (SLs). Mini-bands, mini-gaps and density of states of SLs. Quantum wires and density of states.

Electric-Magnetic Fields and low-dimensional structures. Quantum Hall effect. Aharonov-Bohm effect. Optical absorption in QWs and optical-gain conditions.