The first question one might raise is why are semiconductor materials important in electrical engineering?

- how semiconductor devices are instrumental in many applications?
 - Devices to computing and
 - telecommunications systems
- primary device used in integrated circuits for digital systems, MOSFET.
- Computing hardware will continue to improve, providing faster and more powerful computers.
- 2nd devices for telecommunications applications.
 - devices of use in lightwave communications as well as wireless communications networks. Among these devices are emitters, detectors, amplifiers, and repeaters.
- The development of blue and blue-green light emitting diodes (LEDs) and lasers foments the evolution of new, highly efficient, rugged, ultra-long-life illumination elements. White light emitters using LEDs are now becoming commercially available.

contents

1 Atoms and bonding

- 1.1 The periodic table 1.2 Ionic bonding 1.3 Covalent bonding 1.4 Metallic bonding 1.5 van der Waals bonding 1.6 Start a database 2 Energy bands and effective mass 2.1 Semiconductors, insulators and metals 2.2 Semiconductors 2.3 Insulators
 - 2.4 Metals
 - 2.5 The concept of effective mass

3 Carrier concentrations in semiconductors 3.1 Donors and acceptors 3.2 Fermi-level 3.3 Carrier concentration equs 3.4 Donors and acceptors both present 4 Conduction In semiconductors 4.1 Carrier drift and Carrier mobility 4.3 Saturated drift velocity 4.4 Mobility variation with temperature 4.5 A derivation of Ohm's law 4.6 Drift current equations 4.7 Semiconductor band diagrams with an electric field present 4.8 Carrier diffusion and flux equation 4.10 The Einstein relation 4. 1 1 Total current density 4.12 Carrier recombination

5 Gunn diode

5.1 Domain formation
5.2 The differential form of Gauss's law
5.3 Charge continuity equation
5.4 The dielectric relaxation time

5.5 Operation of the TED

6 p-n junction

- 6.1 The p-n junction in thermal equilibrium
- 6.2 p-n junction barrier height
- 6.3 Depletion approximation, electric field and potential
- 6.4 Mathematical formulation
- 6.5 One-sided, abrupt p-n junction
- 6.6 Applying bias to the p-n junction
- 6.7 Qualitative explanation of forward bias
- 6.8 The ideal diode equation
- 6.9 Reverse breakdown

6.10 Depletion capacitance

7 LED, photodetectors and solar-cell 7.1 The light emitting diode 7.2 Materials for LEDs 7.3 Materials for visible wavelength LEDs 7.4 Junction photodetectors 7.5 Photoconductor 7.6 Photoconductive gain analysis 7.7 Solar-cell 8 Bipolar transistor 8.1 Basic concepts 8.2 Basic structure 8.3 Diffusion capacitance 8.4 Current components 8.5 BJT parameters 8.6 Punch-through 8.7 Modes of operation 8.8 Two simple circuits 8.9 HJBT and polyemitter 8.10 Vacuum microelectronics

9 Fleld-effect transistors

9.1 The MOS diode in thermal equilibrium 9.2 The MOS diode with applied bias 9.3 MOS diode band diagrams 9.4 MOSFET 9.5 MOSFET characteristics - qualitative 9.6 MOSFET characteristics - quantitative 9.7 MOSFET - depletion mode 9.8 MOSFET scaling 9.9 JFET 9.10 JFET equations