PHY 663 - Physics of Semiconductors and Devices

Course Code & Number	Course Name	C.H.	Lec.	Lab.	Tut.
PHY 663	Physics of Semiconductor Devices	4	4	0	0

Syllabus

Energy Bands in Semiconductors: *Electronic structure, Electrons in periodic structures, Semiconductor band structure, Pseudo-potential and kp method, Doping in semiconductors.*

Electronic Effects of Doping Impurities: *Effective mass theory, Donor impurities in Si and Ge, Donor impurities in III-V semiconductors, Acceptor impurities.*

Lattice Vibrations: *Equations of motion, Phonon dispersion curves, Models for calculating phonon dispersion curves, Electron-Phonon interactions.*

Charge Carrier Transport Properties: *Quasi-classical approach, Carrier mobility for a nondegenerate electron gas, Scattering mechanisms, High field transport and hot carrier effects.*

Optical Properties: *Kramers-Kronig relations, Dielectric function, Joint density of states and van Hove singularities, Direct and indirect absorption edges, Excitons, Emission spectroscopes, Light scattering spectroscopes.*

$p-n$ Junctions: *Space charge distribution, Electronic energy bands in the space charge region, p-n junction under an applied voltage, $p-n$ junction capacitance.*

Bipolar Junction Transistor: *Fabrication of transistors, Physical basis of BJT, DC characteristics, Small-signal characteristics.*

Metal-Semiconductor Devices: *Metal-oxide-semiconductor capacitor, Metal-semiconductor diode, Metal-oxide-semiconductor field effect transistor.*

References

- S.M. Sze, Physics of Semiconductor Devices, John Wiley and Sons, 1969.
- W.C.J. Magnus, W.J. Schoenmaker, Quantum Transport in Sub-Micron Devices-A theoretical Introduction, Springer, 2002.
- J. Davies, The Physics of Low-Dimensional Semiconductors: An Introduction, Cambridge University Press, 1998.