

PhotoVolitic effect, History of solar cells, solar radiation, Radiation Absorption and Reflection, Photo action spectrum – impedance spectroscopy – shunt resistance.

Semi conductor Properties: Semiconductor Energy band diagram, extrinsic semiconductors doping and carrier concentration, diffusion and drift of carriers, transport equations, minority carrier diffusion length, continuity equation.

Generation and Recombination in semiconductors: Dark I-V equation of p-n junction, junction under illumination, generation and recombination, optical processes, photogeneration rates, radiative recombination, Shockley Reed Hall recombinations, Auger recombinations.

Solar Cells: solar cell parameters, production of silicon solar cells – fabrications and design, optimization of process parameters, measurements of solar cell parameters-short circuit current, open circuit voltage, fill factor, efficiency. Optical losses, electrical losses, surface recombination velocity, quantum efficiency – external and internal, Thermodynamic and balance of limit efficiency, solar cell thermodynamics, I – V characteristics .

Monocrystalline Solar Cells: Silicon solar cell design, strategies to – enhance absorption, reduce series resistance, surface recombination, Alternatives to Silicon, III – V materials for PV, GaAs Cells. Thin Film Solar cells: Amorphous Si for PV, Materials properties, fabrication , stability, polycrystalline thin film PV Materials, CdTe and CIGS solar cells.

Third Generation Solar Cells: Tandem cells, Hybrid solar cells, organic Solar cells – energy levels in molecular materials, exciton formation, diffusion, dye sensitized solar cells, bulk hetero-junction and hybrid solar cells.

#### **TEXT BOOKS/REFERENCES:**

1. Ben G Streetman , “Solid State Electronic Devices”, Prentice Hall of India Pvt.Ltd., 1995.
2. Nelson J, “The Physics of Solar Cells”, Imperial College Press, 2006.
3. Wenham SR, “Applied Photovoltaics”, Second Edition, Earthscan Publications Ltd., 2007.
4. Green MA, “Third Generation Photovoltaics: Advanced Solar Energy Conversion”, Springer-verlag, 2007.