SS 821 **PHOTOVOLTAICS** **3-0-0-3**

Photovoltaic Effect, History of Solar cells, Solar Radiation, Radiation Absorption and Reflection, Photo action spectrum – impedance spectroscopy – shunt resistance.

Semiconductor 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 – fabrication 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.