Understanding Photovoltaic Effect.

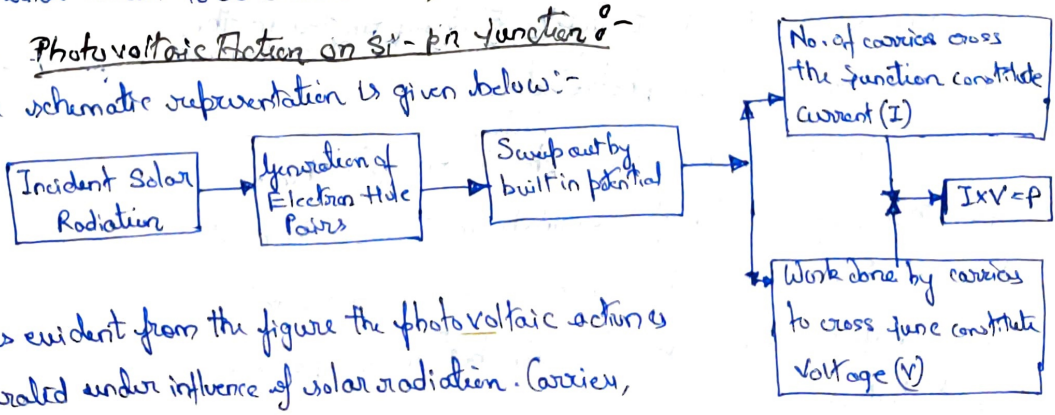
Photovoltaic action on Si-pn junction.

Photovoltaic Effect is a one step process of conversion from light energy into electric energy i.e. the conversion of electromagnetic radiation into electricity. The explanation of PV effect relies from quantum theory of light. In fact light is made of packets of energy, called photons, whose energy depends only upon the frequency i.e. colour of the light. If the energy of visible photons is greater than the band energy gap (i.e. $h\nu \geq E_g$) the each covalent bond will break to liberate two electrons and two holes. So a large number of carriers will be generated. An extreme example of this is the photoelectric effect, the celebrated experiment that was explained by Albert Einstein in 1905, where blue or ultraviolet light provides enough energy for electrons to escape completely from the surface of the metal. Nov ⑧

(Normally, when light is absorbed by matter, photons are given up to excite electrons to higher energy states within the material itself. The excited electrons quickly relax back to their grounded state. In a PV device however, there is some built in asymmetry, which pulls the excited electrons away before they can relax, and feeds them to an external circuit. This extra energy of the excited electrons generates a potential difference, or electromotive force (e.m.f). This force drives the electrons through a load in the external circuit to do electric work)

Photovoltaic Action on Si-pn junction :-

The schematic representation is given below:-



It is evident from the figure the photovoltaic action is generated under influence of solar radiation. Carriers, both holes & electrons, generated due to the breakage of covalent bond through absorption of solar radiation. The electrons thus generated are swept out by the built in potential at the junction. The no. of electrons cross the junction constitute current (I) & the work done by electrons to cross the junction is reflected as the voltage (V). Under the influence of built-in-potential the electrons must thermalize their energy through recombination with holes at the loads by releasing power. Thus it is a power device. ⑨