PHOTO DETECTORS

- Photo detector is a device which converts the light signals to electrical signals.
- The two main photo detectors used for fiber communication system are,

1. PIN photo diode 2. Avalanche photo diode (APD)

PIN PHOTO DIODE

Principle

- Reverse bias is applied to a diode.
- Light is allowed to fall on the neutral (or) intrinsic *'i'* region, electron hole pairs are generated.
- These electrons and holes are accelerated by the external electric field, which results in photo current.
- Thus light is converted into electrical signal.

Construction

1. It consists of 'p' and 'n' regions separated by an intrinsic region *'i'*.
2. 'p' and 'n' regions are made by silicon, germanium and their alloys and they are heavily doped.
3. *'i'* region is lightly doped by 'n' material and made as large as possible to absorb more photons.
4. So it is called as positive-intrinsic-negative (PIN) photo diode.

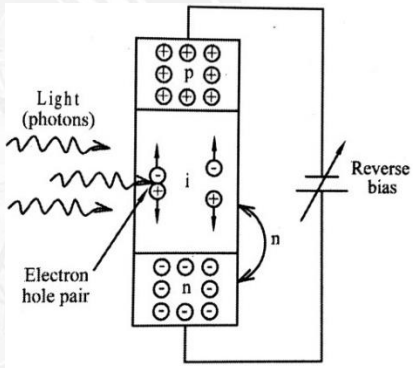

Fig. 5.20

Working

1. When a high reverse bias voltage is applied, the width of the depletion (neutral) region gets increased.
2. When a photon of energy greater than or equal to the band gap energy of the photo diode incidents on the depletion region, the electron hole pairis created due to the absorption of photon.
3. The mobile charges are accelerated by the applied voltage which gives photo current in external circuit.
4. It acts as a linear device because the photo current is directly proportional to the optical power incident.

AVALANCHE PHOTO DIODE (APD)

Principle

- Reverse bias is applied to a diode.
- Light is allowed to fall on the neutral (or) intrinsic *'i'* region, electron hole pairs are generated.

- By avalanche effect more and more number of electron –hole pairs are generated which results in large photo current.
- Thus light is converted into electrical signal.

Construction

1. It consists of four regions p^+, i, p, n^+.
2. Layer (1) consists of heavily doped n region(n^+).
3. The layer(2) is made up 'p' region.
4. Layer(3) is the intrinsic (neutral) region lightly doped with 'p' material
5. Layer(4) is heavily doped with 'p' material.

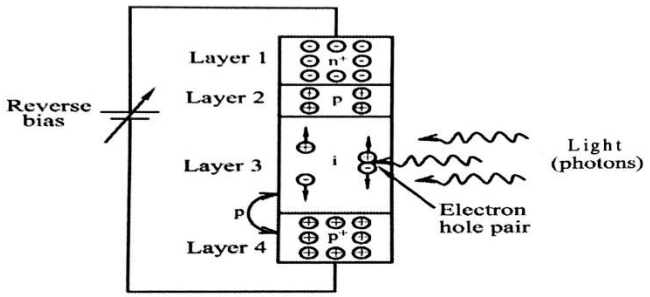

Fig. 5.21

Working

1. When a reverse bias voltage is applied, the width of the depletion (neutral) region gets increased.
2. Light is allowed to fall on the diode;the light is absorbed by the intrinsic region and creates electron hole pairs.
3. When the reverse bias voltage is increased the electrons moves though the intrinsic region to 'p' layer(1) and 'n^+' layer (2).
4. They collide with the electrons in the valence band and produce more free electrons.
5. Thus avalanche effect is produced.
6. Thus, a single electron produces more and more free electrons. So output current increases.
7. So, when a single photon incident on the diode, large current is produced.
8. Hence, these diodes are called as highly sensitive detectors.