SNS COLLEGE OF TECHNOLOGY
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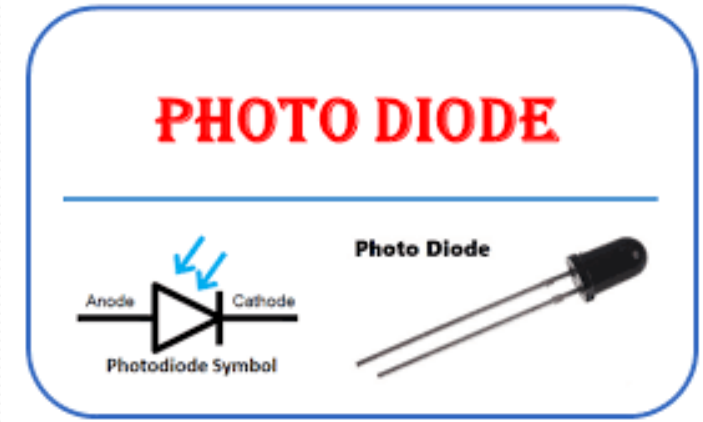
# 23EET104 / ANALOG ELECTRONICS CIRCUITS
## I YEAR / II SEMESTER

**UNIT-I: PN JUNCTION DEVICE**

# Photo Electric Devices

# EMPATHY to SMART

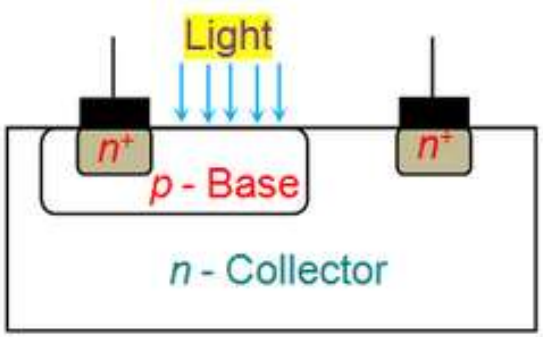



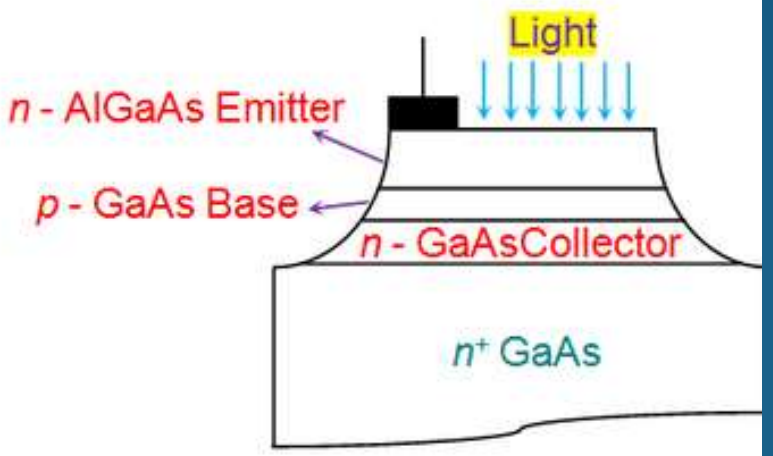

# PHOTO DEVICES

•**Photo devices** are either tri-terminal (emitter, base and collector) or bi-terminal (Diode) semiconductor devices which have a light-sensitive base region.

•Although all transistors exhibit light-sensitive nature, these are specially designed and optimized for photo applications.

•These are made of diffusion or ion-implantation and have much larger collector and base regions in comparison with the ordinary transistors. These devices can be either homojunction structured or heterojunction structured.

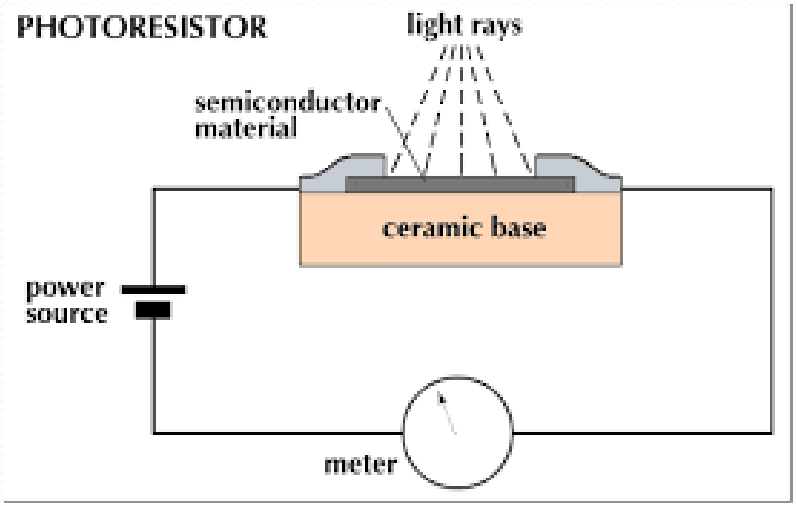


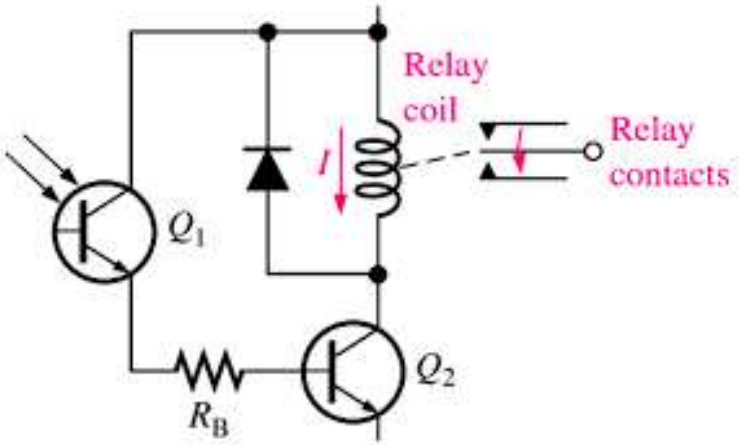



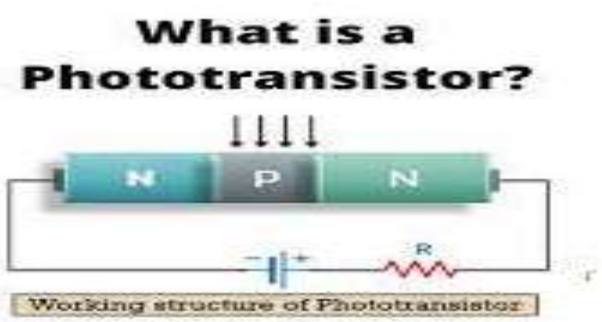

(a) (b)

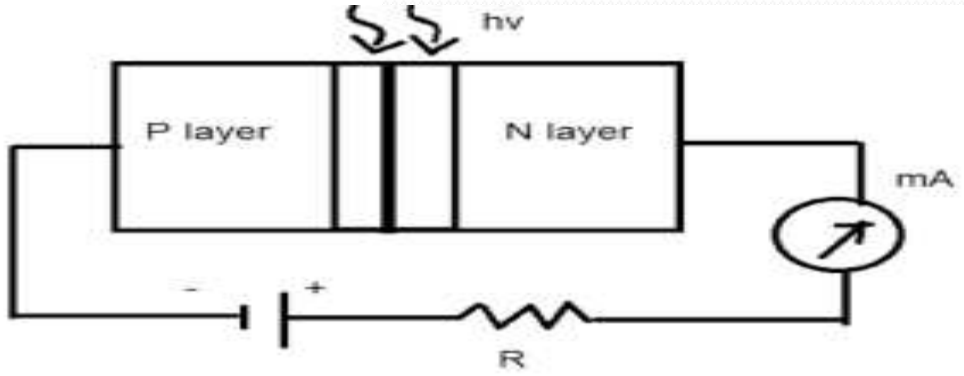
Figure 1 Phototransistor (a) Homojunction Structure (b) Heterojunction Structure

# PHOTO RESISTOR,PHOTO TRANSISTOR, PHOTO DIODE

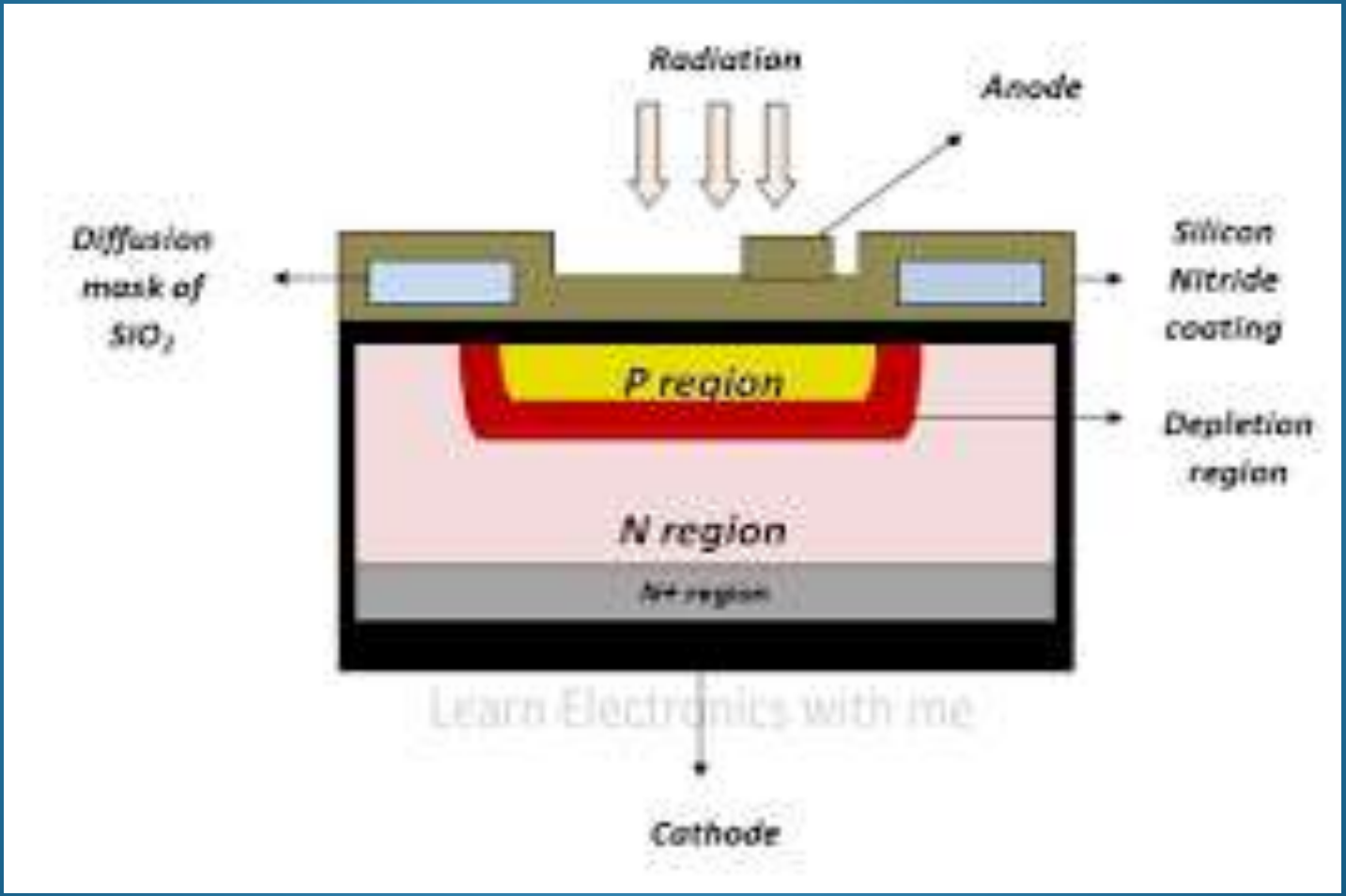


# CONSTRUCTION OF PHOTO DIODE



# OPERATION OF PHOTO DIODE / TRANSISTOR

The circuit symbol for npn phototransistors is shown by Figure 2 which is nothing but a transistor (with or without base lead) with two arrows pointing towards the base indicating its sensitivity to light. Similar symbolic representation holds well even in the case of pnp phototransistors with the only change being the arrow at emitter pointing in, instead of out.


Figure 1 *npn* Phototransistor Symbol with (a) Three Leads (b) Two Leads

## Advantages of Photo Electric Devices

- Simple, compact and less expensive.
- Higher current, higher gain and faster response times in comparison with photodiodes.
- Results in output voltage unlike photo resistors.
- Sensitive to a wide range of wavelengths ranging from ultraviolet (UV) to infrared (IR) through visible radiation.
- Sensitive to large number of sources including incandescent bulbs, fluorescent bulbs, neon bulbs, lasers, flames and sunlight.
- Highly reliable and temporally stable.
- Less noisy when compared to avalanche photodiodes.
- Available in wide variety of package types including epoxy-coated, transfer-molded and surface mounted.

## Disadvantages of Photo Electric Devices

- Cannot handle high voltages if made of silicon.
- Prone to electric spikes and surges.
- Affected by electromagnetic energy.
- Do not permit the easy flow of electrons unlike electron tubes.
- Poor high frequency response due to a large base-collector capacitance.
- Cannot detect low levels of light better than photodiodes.

## Applications of Photo Electric Devices : SMART CITY

- Object detection
- Encoder sensing
- Automatic electric control systems such as in light detectors
- Security systems
- Punch-card readers
- Relays
- Computer logic circuitry
- Counting systems
- Smoke detectors
- Laser-ranging finding devices
- Optical remote controls
- CD players
- Astronomy
- Night vision systems
- Infrared receivers
- Printers and copiers
- Cameras as shutter controllers
- Level comparators

## Any Questions ……


**THANK YOU**