



# SNS COLLEGE OF TECHNOLOGY

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## Department of Biomedical Engineering

Course Name: **23BMB101-Electron Devices and Circuits**

**I Year : II Semester**

**Unit II -Transistors**

**Topic : Phototransistor<sup>1</sup>**



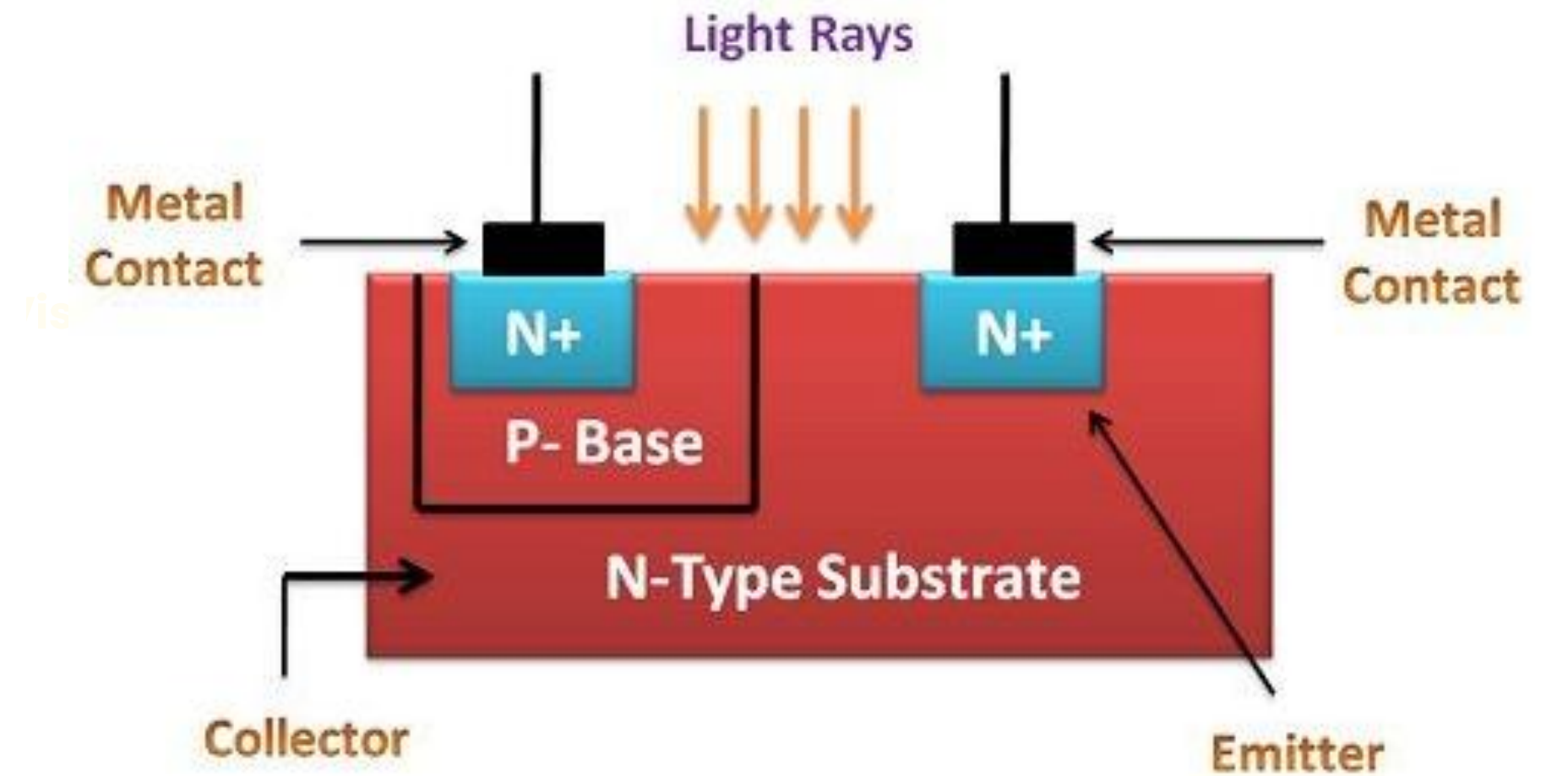
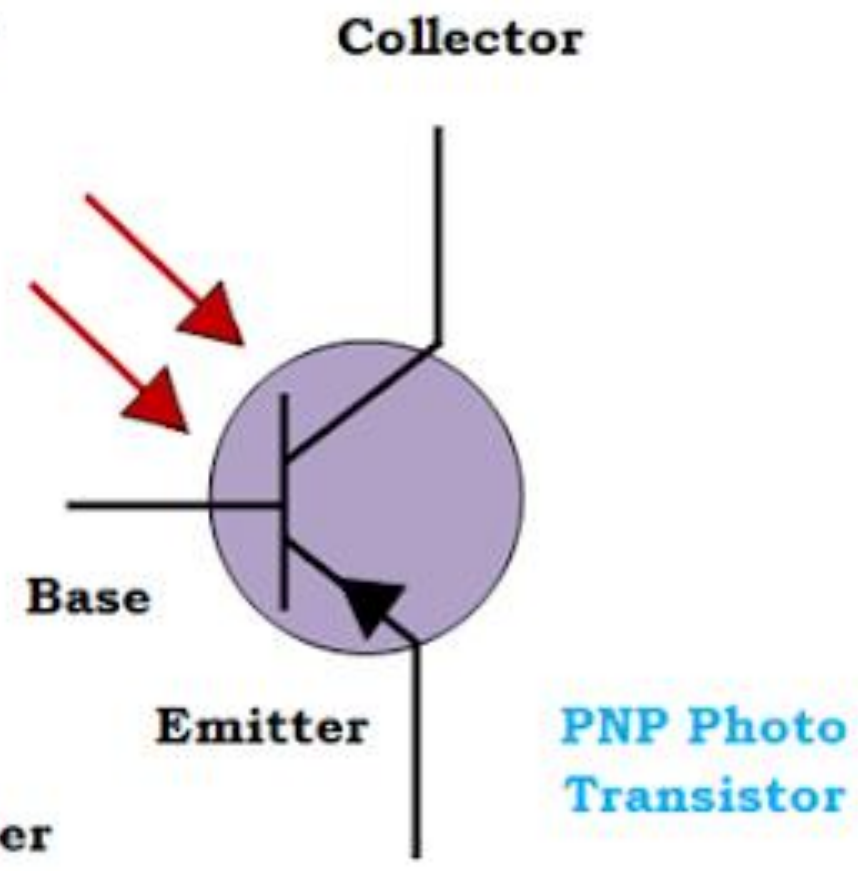
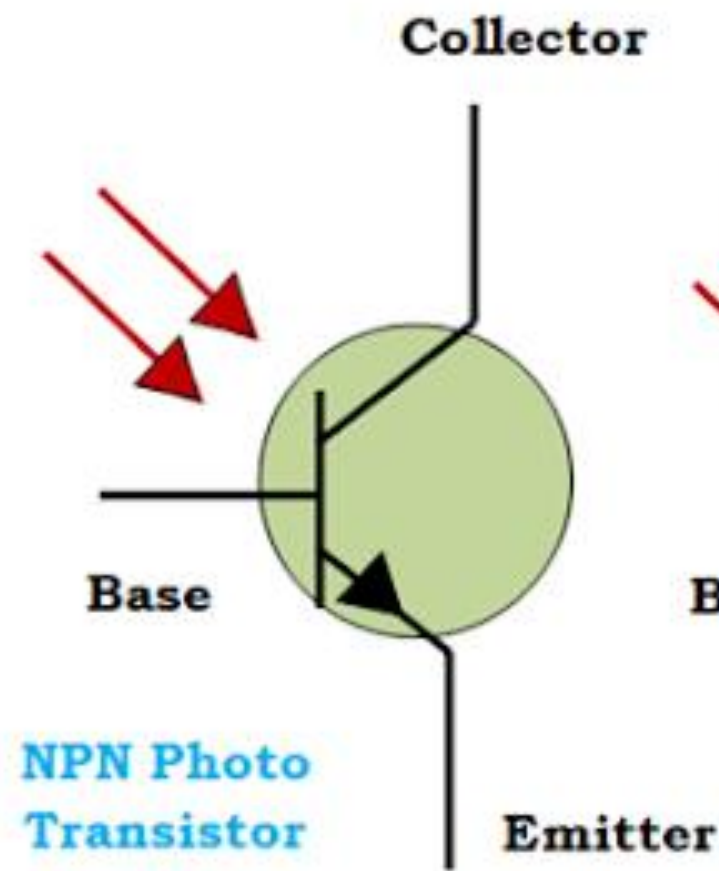
# INTRODUCTION



- A phototransistor is similar to a regular BJT except that the base current is produced and controlled by light instead of a voltage source.
- Instead of providing the base current for triggering the transistor, the light rays are used to illuminate the base region.
- The phototransistor effectively converts light energy to an electrical signal.
- The base terminal is made up of the material which shows sensitivity towards the light.
- The circuit symbol of the phototransistor is similar to that of the conventional transistor but the base terminal can be omitted.
- The two arrows point towards phototransistor indicates that the phototransistor is triggered by the light incident on it.



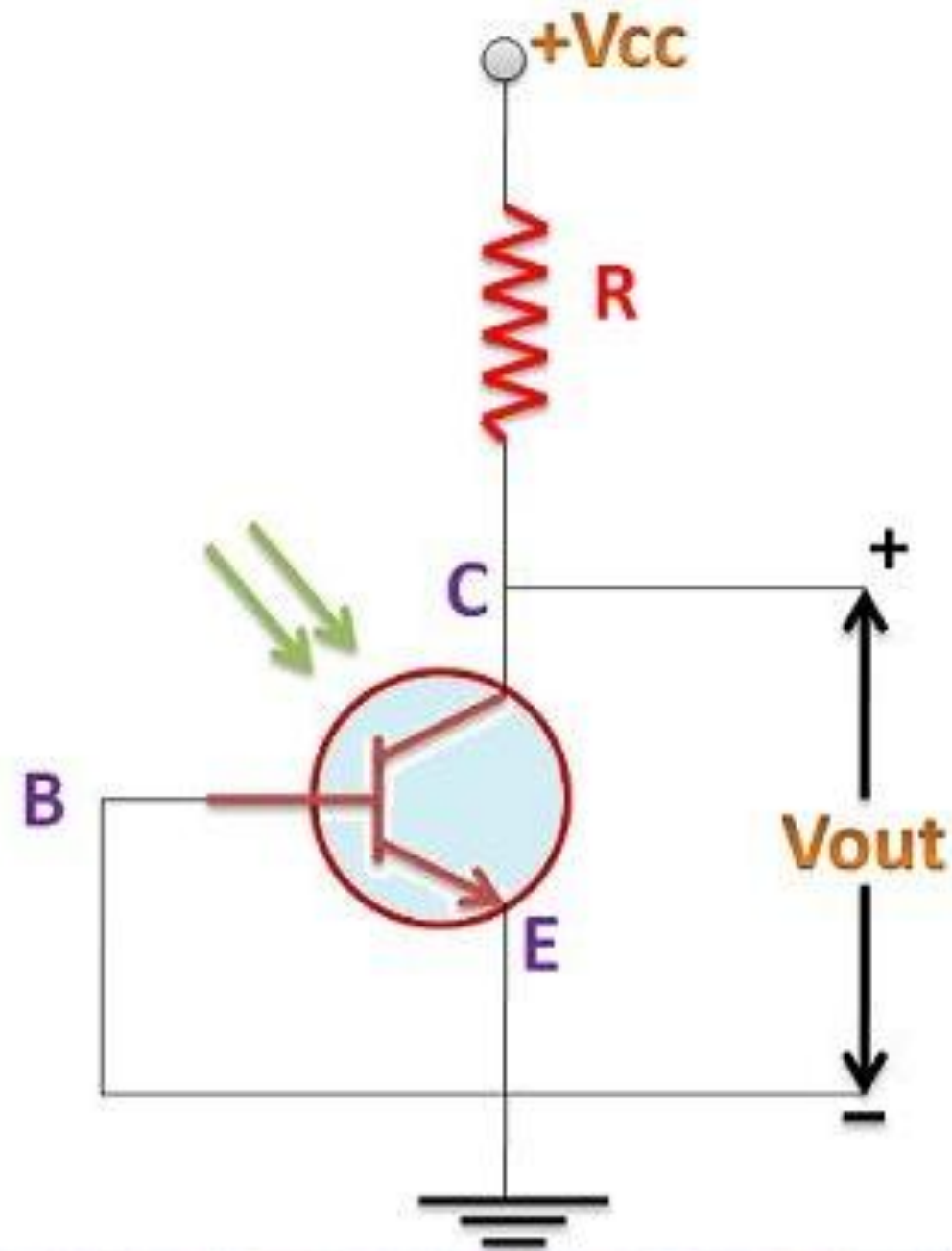
# Construction of Phototransistor



Homo-junction Structure of Phototransistor

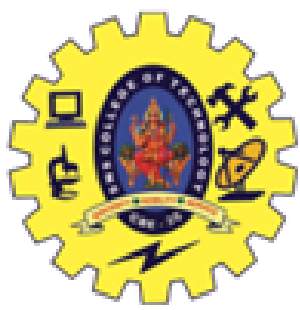


## Working of a Phototransistor



Phototransistor used as a Photodiode

- The output of the phototransistor is taken from the emitter terminal and the light rays are allowed to enter the base region.
- The magnitude of the photocurrent generated by the phototransistor depends on the light intensity of the light falling on the transistor.
- When no light is incident on the base terminal only some leakage current flows and it is called as dark current.



## Working of a Phototransistor

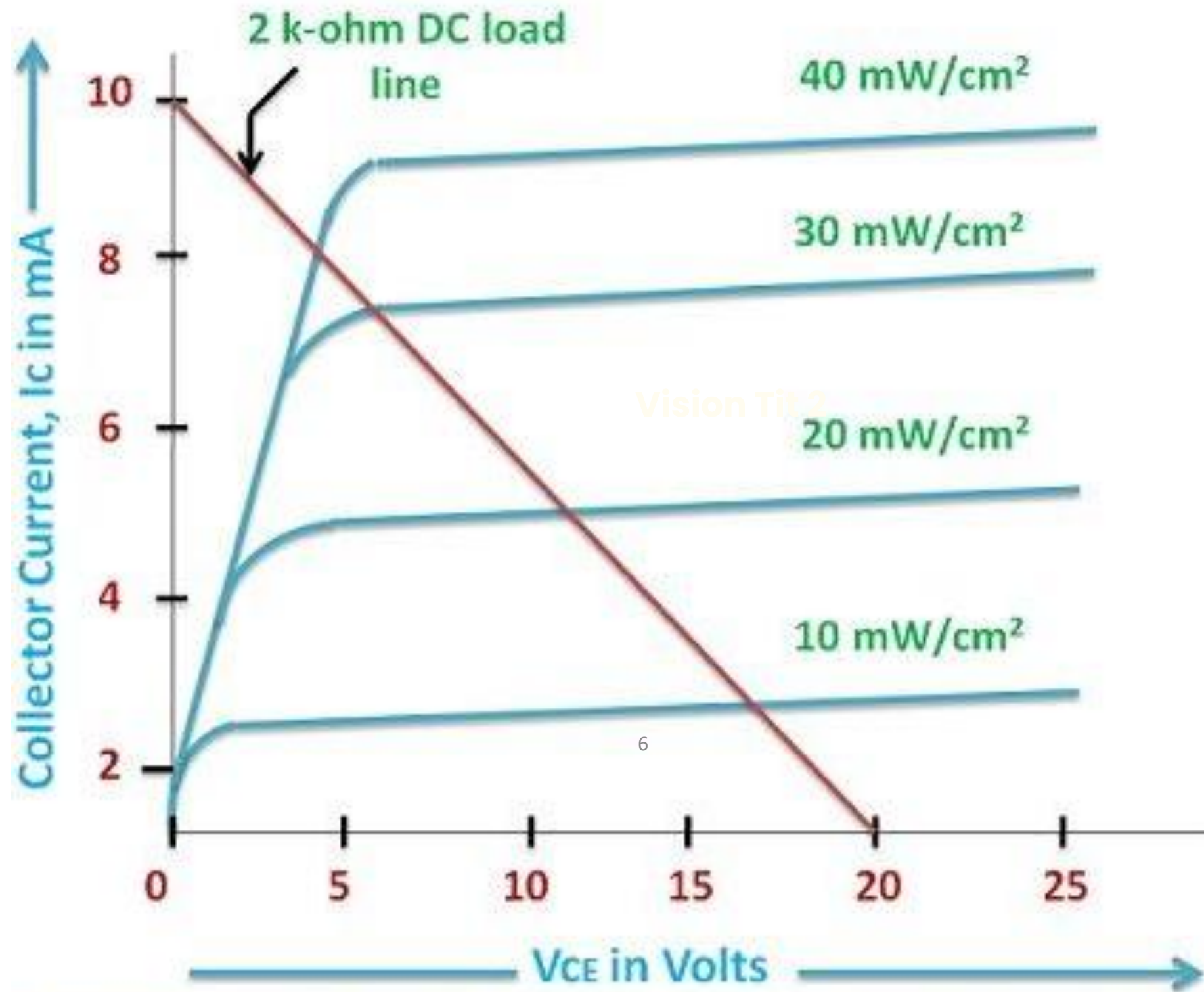
- The phototransistor can be operated in three regions that are the cut-off region, active region, and the saturation region.
- The cut-off region and saturation region can be used to operate the transistor as the switch. The current generated from phototransistor depends on several factors apart from luminous intensity such as

### Vision Tit 2

- ✓ DC current gain of the transistor
- ✓ Time constant
- ✓ Luminous Sensitivity
- ✓ Area of the collector-base junction
- ✓ Wavelength of the incident light



# Characteristics of Photo Transistor



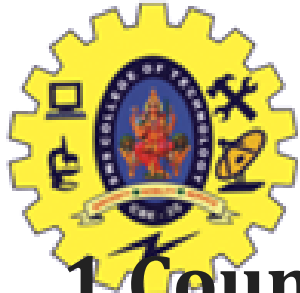
$V_{CE}$  -  $I_c$  Characteristics of a Phototransistors



## Advantages & Disadvantages



Advantages	Disadvantages
Higher Efficiency in Comparison to Photodiode	Effect of Electromagnetic energy
Faster Response	Poor Performance at high frequency
Less Noise interference	Electric spikes
Economical	
Less Complex	



# Applications



- 1.Counting Systems:** The phototransistors are commonly used in counting systems. As this device works with the help of incident light, thus it is much easy to utilize such device in the computing system, as we don't need to worry about power supply.
- 2.Encoder sensing and object detection:** The phototransistors can be used to detect the object or for encoding.
- 3.Printers and Optical control remotes:** Due to its high light to current conversion efficiency, it is commonly used in optical devices such as remotes, printers etc.
- 4.Light detector:** The most crucial application<sup>8</sup> of phototransistor is to use it as the light detector. This is because it can detect even a small amount of light because it is highly efficient.
- 5.Level Indication and Relays:** The phototransistors are also used to indicate the level in the various system. They also play a vital role in relays and punch cards.