



# **SNS COLLEGE OF TECHNOLOGY**

**(An Autonomous Institution)**



**COIMBATORE-35**

**Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai**

**DEPARTMENT OF BIOMEDICAL ENGINEERING**

**COURSE NAME: 19EIB201/ ELECTRONIC DEVICES**

**II YEAR / III SEMESTER**

**Unit 1 – PN Junction Devices**

**Topic 2: Zener Diode**





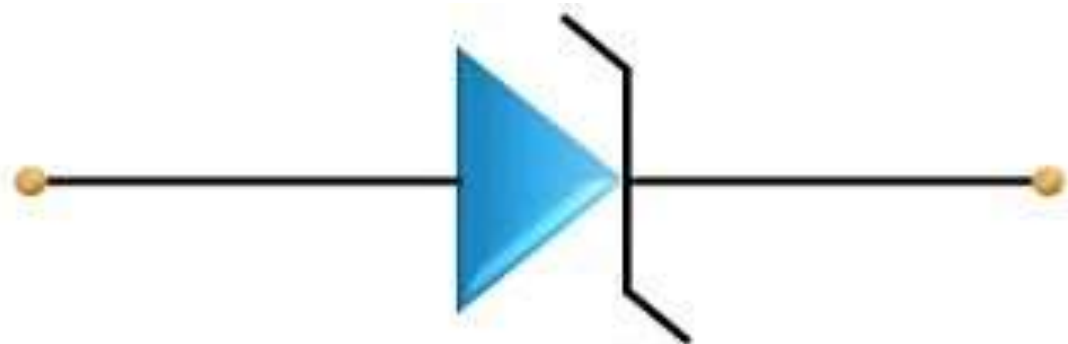
# Zener Diode



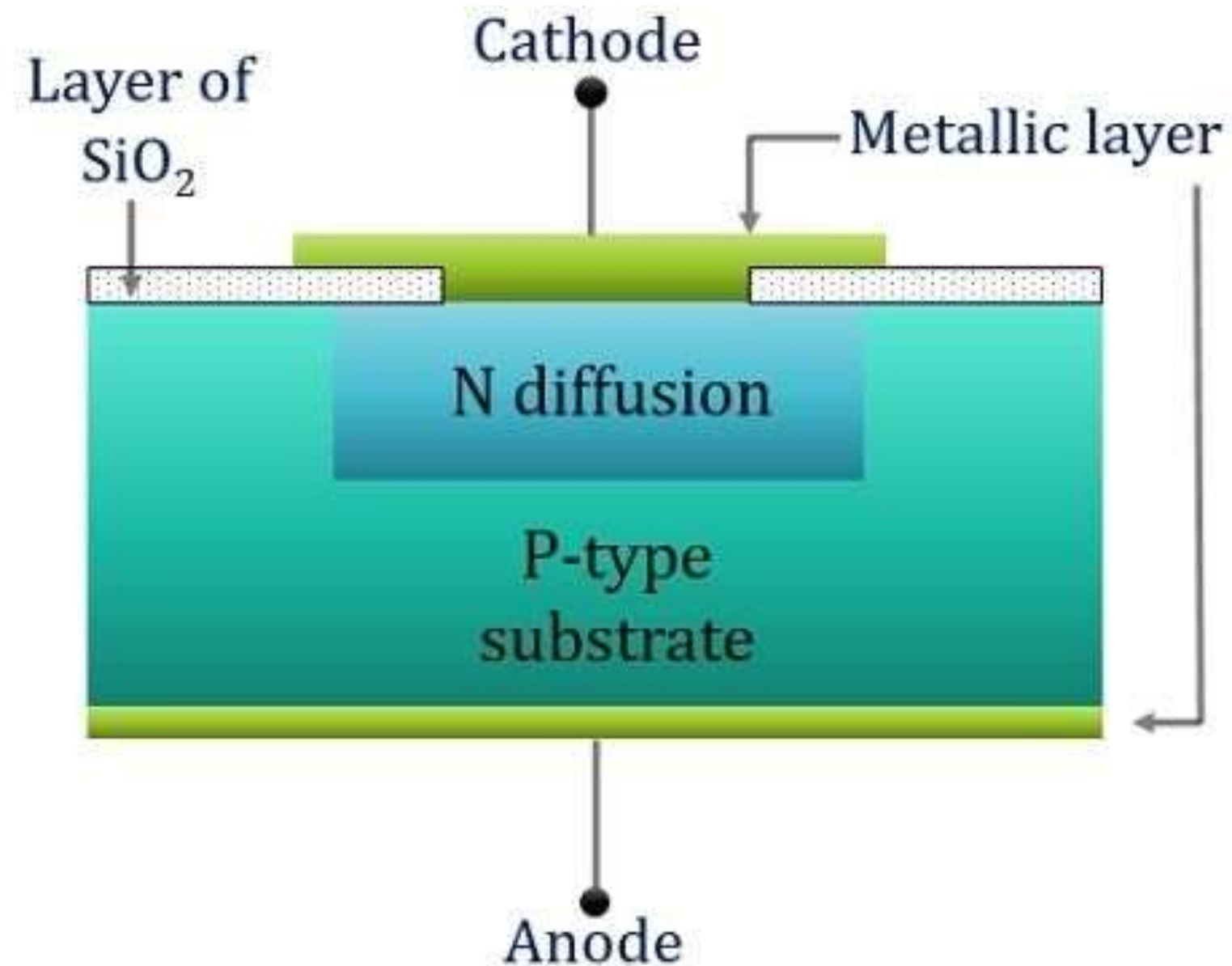
- A Zener Diode, also known as a breakdown diode, is a heavily doped semiconductor device that is designed to operate in the reverse direction.
- When the voltage across the terminals of a **Zener diode** is reversed and the potential reaches the Zener Voltage (knee voltage), the junction breaks down and the current flows in the reverse direction. This effect is known as the **Zener Effect**.



# Zener Diode



Symbol of Zener Diode



Structure of Zener Diode



# Working

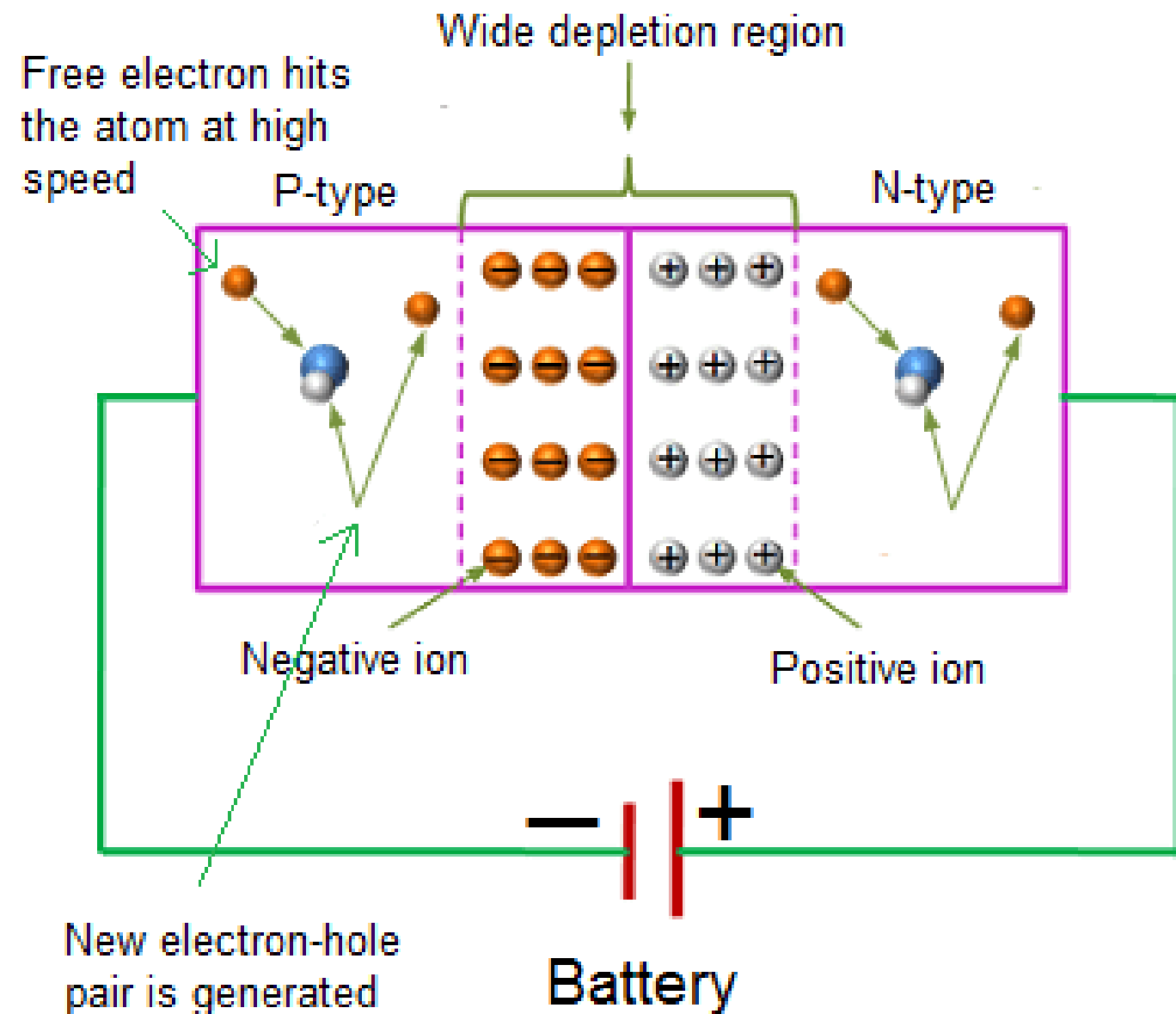


- Zener diode allows electric current in forward direction like a normal diode but also allows electric current in the reverse direction if the applied reverse voltage is greater than the Zener voltage.
- Zener diode is always connected in reverse direction because it is specifically designed to work in reverse direction.
- Zener diode is highly doped thus its depletion width is very thin. Due to this, more current flows through a zener diode as compared to a normal junction diode.
- A zener diode shows two breakdown approach, zener breakdown, and avalanche breakdown.





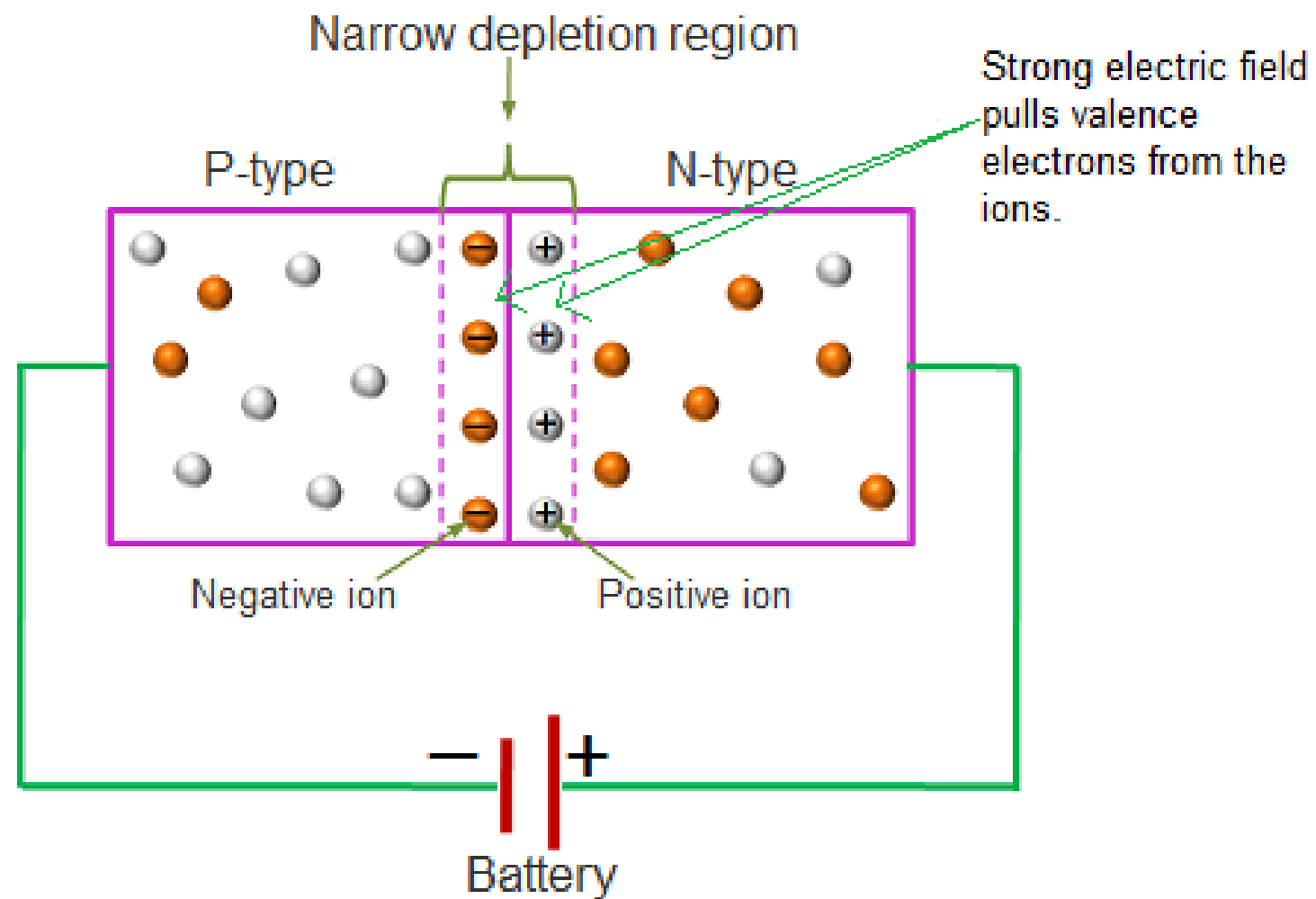
# Avalanche breakdown



- When high reverse voltage is applied to the p-n junction diode, the free electrons (minority carriers) gain a large amount of energy and are accelerated to greater velocities.
- These electrons are again accelerated and collide with other atoms.
- As a result, electric current in the diode increases rapidly.
- Avalanche breakdown occurs in zener diodes with zener voltage ( $V_z$ ) greater than 6V



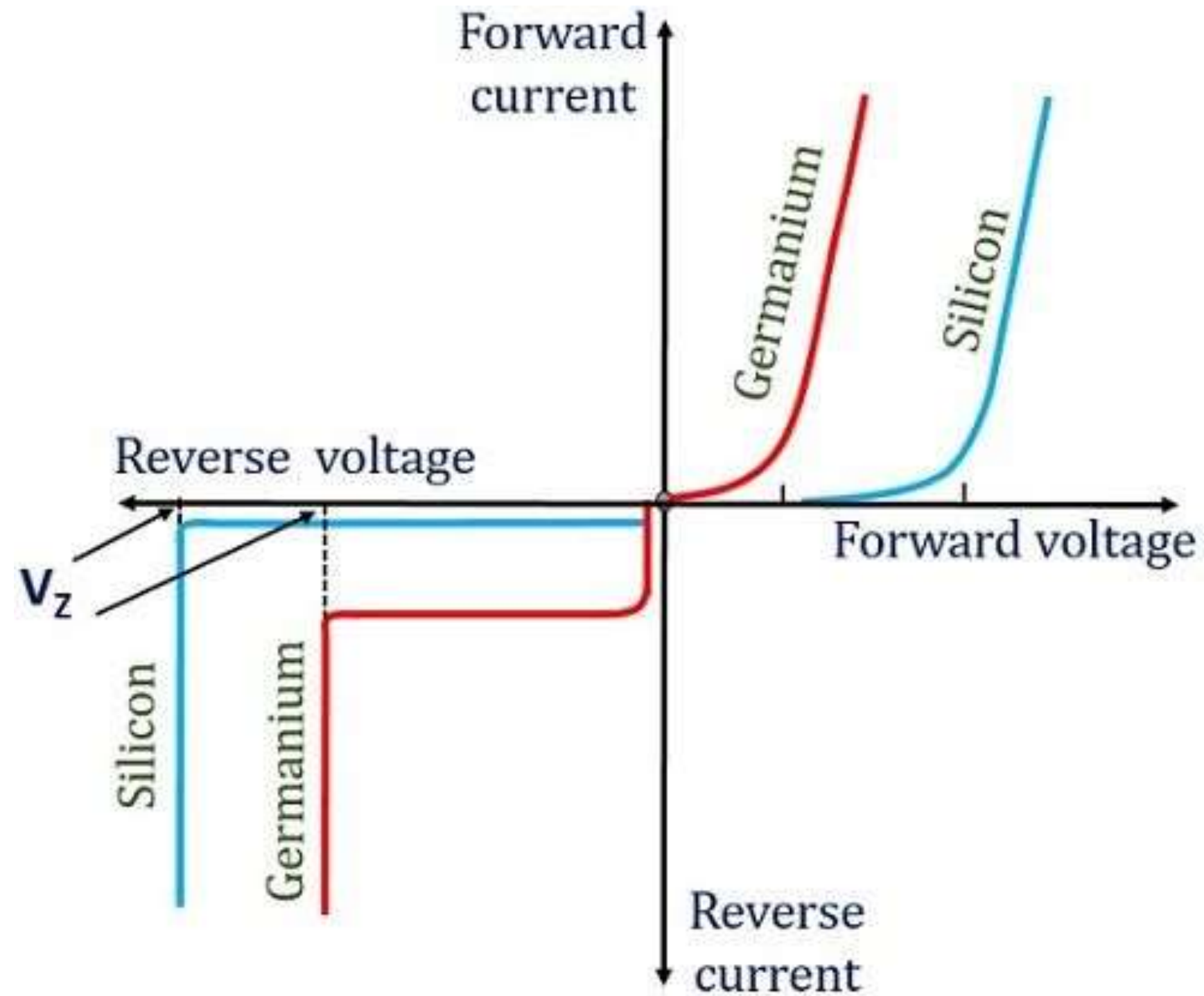
# Zener breakdown



- The zener breakdown occurs in heavily doped p-n junction diodes because of their narrow depletion region.
- When reverse biased voltage applied to the diode is increased, the narrow depletion region generates strong electric field.
- When reverse biased voltage applied to the diode reaches close to zener voltage, the electric field in the depletion region is strong enough to pull electrons from their valence band.
- At zener breakdown region, a small increase in voltage will rapidly increases the electric current.



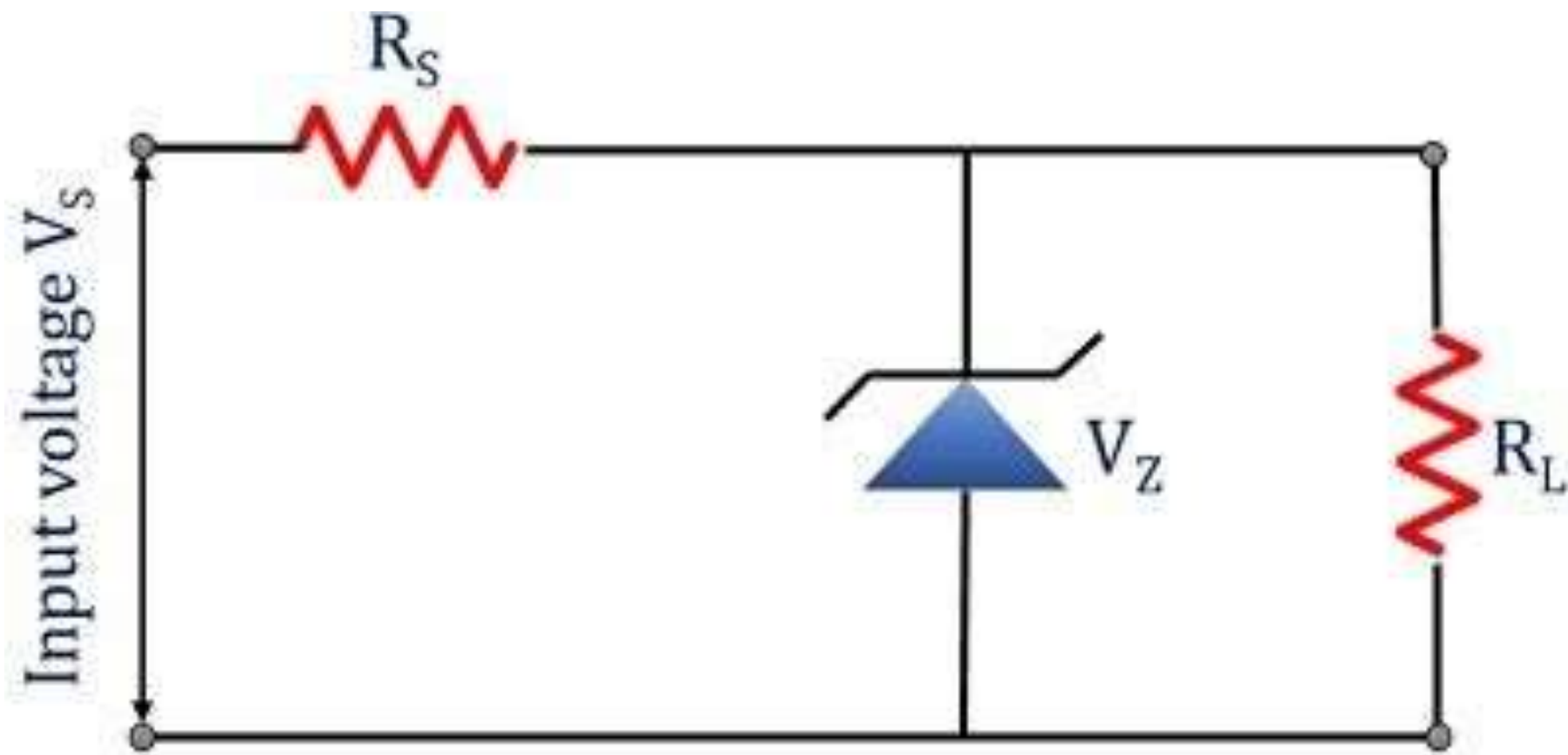
# V-I characteristics of zener diode



V-I characteristics of Zener Diode



# Voltage Regulator



- Regulating the voltage of a circuit is its ability to keep the output voltage fixed regardless of the variation in input voltage or load current.
- Until load voltage is less than the breakdown voltage, the zener diode does not show conduction.
- As the voltage at the load increases than breakdown voltage, the device now starts conduction in the breakdown region. Thus, at the breakdown region, a constant voltage is maintained





# SUMMARY

Definition, Macro and Micro Economics, Nature and Scope of Economics



KEEP  
LEARNING..  
**Thank u**

SEE YOU IN NEXT CLASS