Fundamental of Semiconductor devices:

You are very well aware that all our cell phones, mobiles, laptop, ThinkPad's, everything we have processors, memory devices, logic devices, they are all made of semiconductor devices.

The transistor which revolutionized our electronics industry that transistor is one of the most important semiconductor devices that was invented and that has eventually triggered the IC revolution, the integrated circuit revo

for ex, electric vehicles, semiconductor devices to enable charging of these vehicles. convert power kw to watt (or) watt to kilowatt

High speed application like radars and satellite transmission communication also need transistors that can operate at very high speed and very high power.

semiconductor devices are also used for optical devices.

All white light LEDs that you are using now to light up, the street, the stadiums, the houses everything that white light LED is a semiconductor device.

Solar cells are semiconductor

Photo detectors and photo sensors are also semiconductor mostly

Semiconductor is something that has a conductivity between metal and insulator.

Conductor is what conducts electricity very well like metals and insulators are like wood and glass which cannot carry electricity so much.

This word semiconductor means those materials whose conductivity can be tuned or tailored.

Conductivity → resistance
(It follows ohm's law) $R = \frac{V}{I}$

Conductivity is sort of the reciprocal of resistance or resistivity

Use Semiconductor as a switch (ON/OFF state), an amplifier, logic device

Semiconductor allow very high current to flow, it can also block very large voltages like insulators.

Amplifier does?

It amplifies, it enlarges the signal, has a gain and that gain has used in many RF devices

As a logic device your CMOS logic as a memory device, it can use it is as for memory where to store information

Semiconductor use it as an LED that emits light, laser diode in a laser pointer, solar cell, photo detector

Basics

- Band Diagram
- Electrons and holes
- Doping (Doping is basically the ability that the process of changing the conductivity of a material)
- Statistics - Fermi-Dirac statistics
- Transport (current transport in semiconductor)
- Carrier Recombination
- P-N junction

Devices

- MOS/MOSFET
- BJT
- Solar Cell
- LED
- Photo Detector
- Transistor and Diodes — high speed application / high power / low noise

In 1948, first transistor - BJT was invented at Bell labs in US.

The number of transistors in a chip double every roughly every one and half years and that is called Moore's law.

More transistors in each of this chip, then the complexity and functionalities also become large.

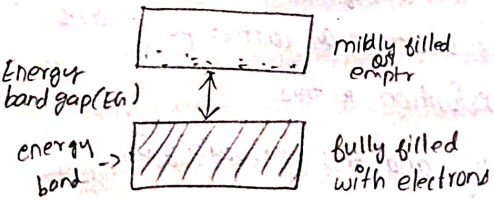
The transistor is a device where the current flowing between two terminal A and B is not decided by the voltage that you applying between A and B, but by the voltage you applying at another point C, so that means, the voltage that you apply at point c can control how much current is flowing between A and B. So it is be used as a switch, amplifier and so on.

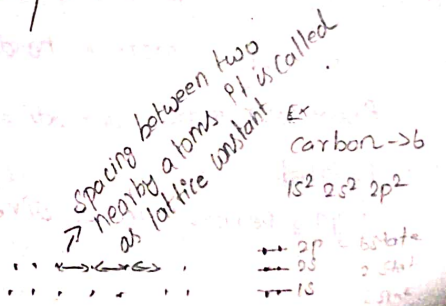
14 nanometer node — line 1mm

Semiconductor devices or semiconductor is called bands or Energy band.

-> Silicon and Germanium } Elemental semiconductor
Carbon

-> Gallium + Arsenic = Gallium Arsenide (Ga-As) -> It is a compound
Compound semiconductor





(1s²) -> inner most orbital
It do not take part in interaction
Electrons also do not contributed to energy band gap formation.