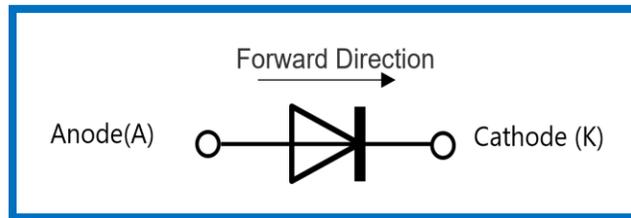


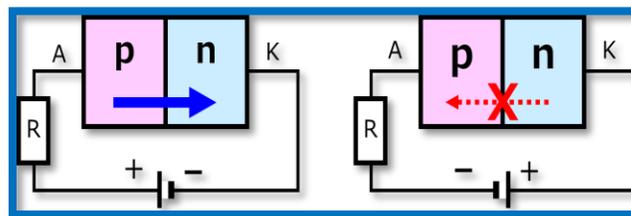
### UNIT 3: SEMICONDUCTOR DIODE

A diode is a semiconductor device with one PN junction or alternatively one metal-semiconductor junction. It has two terminals called anode and cathode.



*Fig. 1 Symbol of diode and names of its electrodes*

A diode conducts electric current only when it is forward-biased (i.e., when the anode is more positively biased than the cathode) (Fig. 2). This function of allowing current to flow in only one direction is called rectification.



*Fig. 2 Polarity of Diode*

Fig.3 illustrates what happens when voltage is supplied across a silicon PN junction diode. The first quadrant of the graph shows the characteristics of the diode when the source relates to the positive to the P-side of the conjunction and the negative to the N-side.

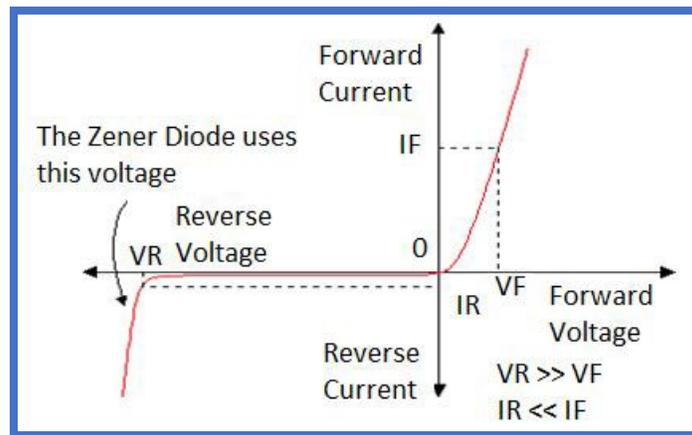


Figure 3. Characteristics of the diode

In the other words, the diode is forward biased. With the forwards bias, the current at first increases slowly. When the applied voltage reaches about 600 mV, the current rises rapidly. The diode is then a good conductor. The current will continue to rise with increased voltage but eventually a point will be reached where the diode is destroyed by the heat.

The third quadrant shows the characteristics when the source is connected with the positive to the N-side and the negative to the N-side. When the diode is reserved biased, there is almost no current to flow. The junction is therefore a good rectifier: it conducts well in one direction and almost not at all in the other. However, there is a small, reversed leakage current. This leakage current remains substantially constant until what is known as breakage voltage (Vb) is reached. At this point, there is a sharp increase in the reverse current. This sudden increase in current is called Zener effect.

Normal diodes are never operated in the breakdown region, but Zener diodes are designed to make use of the breakdown phenomenon. Because any slight increase in the voltage beyond the breakdown point causes a large increase in current. Zener diodes are often used as a kind of overspill to protect sensitive circuit from fluctuation in the power supply.

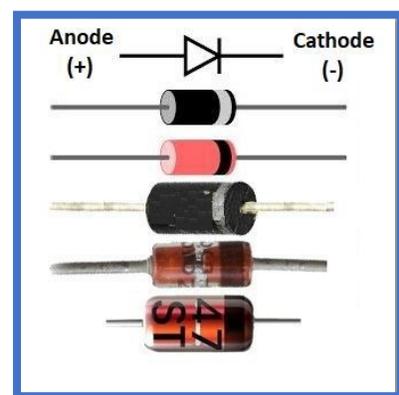


Figure 3.2: Typical diodes

## I. VOCABULARIES

- ***Crystal*** : The solid state of many simple substances, which have a regular shape and surfaces arranged in similar patterns
- ***Quadrant***: a quarter of an area
- ***Positive***: more than zero
- ***Negative*** :less than zero
- ***Bias***: A steady voltage, magnetic field, or other factor applied to an electronic system or device to cause it to operate over a predetermined range
- ***Junction***: a place where things, esp. roads and railroads, meet or join
- ***Leakage***: situation in which a liquid or gas escapes from an opening in a pipe or container, or the amount that escapes
- ***Beyond***: more than, further away in the distance
- ***Overspill***: the action or result of spilling over or spreading into another area

## II. READING AND COMPREHENSION

**Exercise 1:** *Select the words from the three alternatives given which is most similar in meaning to the word in italics it is used in the passage:*

1. *Characteristics*
  - a. **Typical behavior.**
  - b. Voltage figures.
  - c. Graph.
2. *Substantially*
  - a. **Almost**
  - b. Greatly
  - c. Hardly
3. *Sharp*
  - a. Slight
  - b. **Steep**
  - c. Cutting

4. *Phenomenon*
  - a. Voltage
  - b. Effect**
  - c. Result
5. *Fluctuations*
  - a. Rises and falls**
  - b. Increases
  - c. Failures

### Exercise 2: Checking facts and ideas

Decide if these statements are true or false. Quote from the passage to support your decision:

1. The first quadrant of the graph shows the characteristics of the diode in the forward bias.(T)
2. For forward voltage over 600 mV, the diode conducts well.(T)
3. When the source is connected with the negative to the N-side and the positive to the P-side, the diode is reverse biased.(F) The diode is forward biased
4. When a reverse voltage is at first applied, a diode conducts badly.(T)

## III. USE OF ENGLISH

### Exercise 3: Study this term from electronics:

## Semiconductor

We can divide it into three parts:

### Semi/conduct/or

**Semi** is a prefix which means “half”, while **or** is a suffix add to the verb **conduct** to make noun. From this we can work out that a semiconductor is a component which half conducts, i.e. it conducts in one direction only.

Knowledge of common prefixes can help us to work out the meaning of some unfamiliar term in electronics.

Study this table. Try to think of other examples to add.

Prefix	Meaning	Exemple	Other
<b>De-</b>	Reverse the action	Decouple	<p><b>Demodulation</b></p> <p>Deconstruct: Break down into components.</p> <p>Decode: Convert a coded message into plain text</p> <p>Deduplicate: Eliminate duplicate data or elements</p>
<b>Dis-</b>	Opposite the action	Discharge	<p>Disadvantage</p> <p>Disconnect: Separate or break the connection between components.</p> <p>Discharge: Release stored energy, often referring to discharging a capacitor or battery.</p> <p>Disassemble: Take apart electronic components or devices.</p>
<b>Micro-</b>	Small	Microchip	<p>Microcontroller: A small computer on a single integrated circuit used to control electronic systems.</p> <p>Microprocessor: An integrated circuit that contains the functions of a central processing unit (CPU) on a small scale.</p> <p>Microchip: A tiny piece of semiconductor material that contains an integrated circuit or microprocessor.</p> <p>Microcircuit: A miniature electronic circuit typically implemented on a small chip or substrate.</p> <p>Microelectronics: The study and application of extremely small electronic components and circuits.</p> <p>Microscale: Referring to the small scale or dimensions of electronic components or systems.</p> <p>Microwave: Electromagnetic waves with wavelengths shorter than those of radio waves, commonly used in communication and heating.</p>
<b>Multi</b>	Many	Multimudia	<p>Multimedia: Involving the use of multiple forms of media, such as text, audio, images, and video.</p> <p>Multiresolution: Involving or providing solutions or representations at multiple levels of detail or resolution.</p> <p>Multifunction: Having or performing multiple functions or capabilities.</p> <p>Multiplexing: Combining multiple signals or data streams into a single channel for transmission.</p> <p>Multithreading: A programming technique that enables multiple threads (smaller units of a process) to be executed concurrently.</p> <p>Multiprocessing: The use of multiple processors or central processing units (CPUs) in a computer system.</p>

			<p>Multimeter: An electronic measuring instrument that combines multiple measurement functions, such as voltage, current, and resistance.</p> <p>Multichannel: Involving or capable of handling multiple channels of data or signals simultaneously.</p> <p>Multivibrator: An electronic circuit that generates continuous square wave or rectangular waveforms.</p>
<b>Tele-</b>	<b>Far</b>	<b>Television</b>	<p>Television: A system for transmitting visual images and sound that are reproduced on screens.</p> <p>Telecommunication: The transmission of signals, messages, or information over a distance using electronic systems.</p> <p>Telescope: An optical instrument that gathers and magnifies distant objects for observation.</p> <p>Teleport: Transport or transmit a person or object instantaneously to a distant location.</p> <p>Telegraph: A system for transmitting messages over long distances using coded signals.</p> <p>Telephone: A device for transmitting sound over long distances, enabling voice communication.</p> <p>Telepathy: Communication between minds without the use of traditional senses.</p> <p>Telematics: The integration of telecommunications and informatics, often used in vehicle tracking systems.</p> <p>Telemedicine: The provision of medical services remotely using telecommunications technology.</p> <p>Televise: To broadcast or transmit a program or event on television.</p>
<b>Trans-</b>	<b>Across</b>	<b>Transmitter</b>	<p>Transmitter: A device that sends signals or information across a distance, often in the form of radio or electromagnetic waves.</p> <p>Transporters: Devices or systems that move people or goods from one place to another.</p> <p>Transducers: Devices that convert one form of energy into another, often used in sensors or measurement instruments.</p> <p>Transatlantic: Crossing or relating to the Atlantic Ocean.</p> <p>Translate: To convert text or speech from one language to another.</p> <p>Transcontinental: Crossing or spanning a continent.</p> <p>Transmission: The process of sending signals or data across a medium, such as wires or airwaves.</p> <p>Transparent: Allowing light to pass through, making objects on the other side visible.</p>

### Exercice 05: Describing purpose

Study these ways of description the purpose of Random Access Memory (RAM)

1. RAM is used for the temporary storage of programs and data.
2. RAM is used for storing programs and data temporarily.
3. RAM is used to store programs and data temporarily.

Now identify each of electronic components or pieces of equipment described below.

1. It is used to change AC voltage from small to large or from large to small. (**Transformer** )
2. It is used to measuring very small current.( **milliammeter**)
3. It is used as part of a burglar alarm to detect movement.( **motion detector**)
4. it is used for receiving of RF signals.( **RF receiver**)
5. It is used for protecting circuit from surge in voltage.(**fuse**)

## IV. FURTHER READING

### TRANSISTORS

A transistor is a semiconductor device that functions as an electronic switch or amplifier. It consists of three layers of semiconductor material: the emitter, base, and collector. The two main types of transistors are bipolar junction transistors (BJTs) and field-effect transistors (FETs). BJTs utilize the movement of charge carriers (electrons and holes) for amplification and switching, while FETs rely on an electric field to control the flow of charge carriers.



In a BJT, the current flowing between the collector and emitter is controlled by the current flowing into the base. This property allows transistors to function as amplifiers, where a weak signal at the input (base) can control a much larger signal at the output (collector). They are commonly used in audio amplifiers, radio frequency circuits, and signal processing applications.

FETs, on the other hand, control the flow of current between the source and drain terminals through the application of an electric field at the gate terminal. FETs are known for their high input impedance and are often used in applications where low power consumption is critical, such as in integrated circuits, amplifiers, and oscillators.

Transistors find extensive use in various electronic applications. In amplifiers, they are employed to increase the strength of weak signals, facilitating audio and radio frequency amplification. Transistors are integral components in digital circuits, serving as switches in binary systems and forming the basis of logic gates in computer processors. They are also crucial in power electronics for voltage regulation and control.

Furthermore, transistors are vital in communication systems, acting as modulators and demodulators in devices like radios and televisions. In microelectronics, transistors are the building blocks of integrated circuits, enabling the creation of complex electronic devices like microprocessors, memory chips, and other semiconductor-based components.

In summary, transistors are fundamental semiconductor devices with diverse applications in electronics. Their ability to amplify and control electrical signals has revolutionized the field, paving the way for the development of advanced electronic systems and devices.

Read the passage carefully and answer the questions below:

1. How does a BJT control the current flowing between the collector and emitter?

- a. By adjusting the resistance in the base
- b. By applying an electric field at the gate
- c. By utilizing the movement of charge carriers
- d. By controlling the flow of photons

**Answer:** c. By utilizing the movement of charge carriers

2. What is a notable characteristic of FETs mentioned in the passage?

- a. Low input impedance
- b. High power consumption

- c. Reliance on charge carriers for control
- d. Control of current flow through an electric field

**Answer:** d. Control of current flow through an electric field

3. In what applications are transistors commonly used as switches in binary systems?

- a. Audio amplifiers
- b. Power regulation circuits
- c. Digital circuits
- d. Radio frequency circuits

**Answer:** c. Digital circuits

4. What is a crucial role of transistors in microelectronics mentioned in the passage?

- a. Serving as resistors in integrated circuits
- b. Forming the basis of logic gates in computer processors
- c. Controlling inductance in semiconductor devices
- d. Acting as modulators in communication systems

**Answer:** b. Forming the basis of logic gates in computer processors

5. What are the three layers of semiconductor material in a transistor?

- a. Anode, cathode, and gate
- b. Emitter, base, and collector
- c. Source, drain, and gate
- d. Positive, negative, and neutra

**answer:** b. Emitter, base, and collector