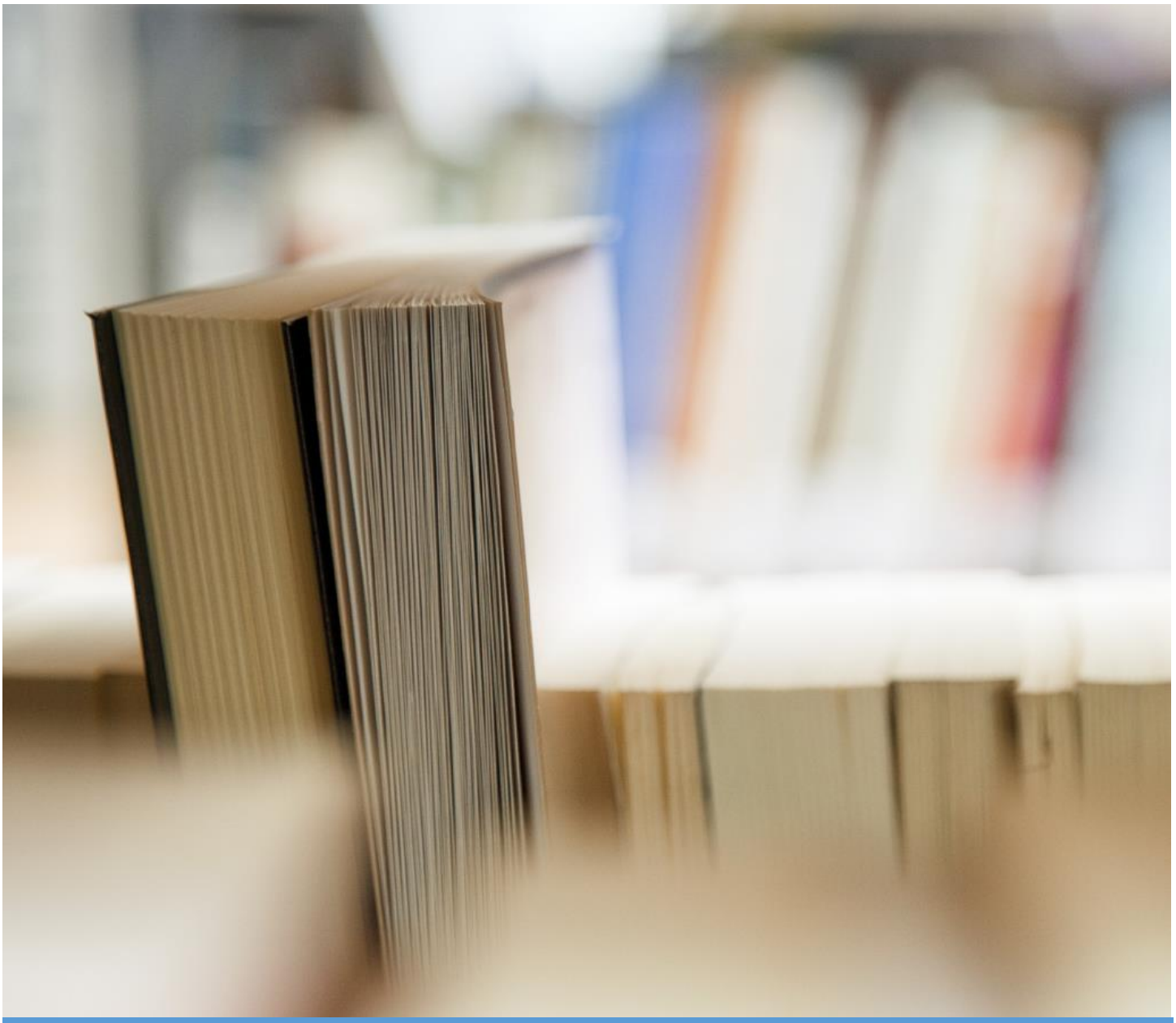

FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

CHAPTER 1 SOLUTION

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CHAPTER – 1 OVERVIEW OF ELECTRIC COMPONENTS AND SIGNALS

2 MARKS QUESTIONS

1. Give application of Diode.

- The most basic function would be changing AC current to DC current by removing some part of the signal. This functionality would make them rectifiers. They are used in electrical switches and are used in surge protectors because they can prevent a spike in the voltage.
- Diodes help in performing digital logic. Millions of diodes are used similar to logic gates and used in modern processors.
- They are used for isolating signals from a supply. For example, one of the major uses of diodes is to remove negative signals from AC current. This is known as signal demodulation. This function is basically used in radios as a filtering system in order to extract radio signals from a carrier wave.
- The light emitting diodes or LEDs are used in sensors and also in laser devices any many other light illumination devices.
- Diodes are the basis of op-amps and transistors.

2. Give application of Transistor.

- The core use of transistors includes switching applications or both amplification and switching.
- There is a kind of transistors that produce current flow depending on the amount of light shined upon them; those are known as phototransistors.
- Bipolar Junction Transistors (BJT) can cause a greater current flow from the emitter to the collector when a small amount of current is passed through the base.
- Schottky Transistors divert high input currents and prevent the transistors from saturating.

- Multiple Emitter Transistors are used in Transistor-Transistor Logic (TTL) and NAND logic gates.
- Dual Gate MOSFETs are used in RF mixers/multipliers and RF amplifiers where two controlled gates are required in a series.
- Avalanche Transistors can switch high currents in less than nanosecond transition times.

3. What are active Components?

Active Components: An active component is an electronic component which supplies energy to a circuit or ability to control electron flow (i.e., the flow of charge). All electronic circuits must contain at least one active component.

4. Write Examples of active components.

Active component has two types:

- Energy source: Voltage source and current source.
- Signal processing component which can process the electrical signal.
- All different types of transistors (BJT, FET, MOSFET, JFET)
- Diodes (Zener diode, photo diode, LED etc.)

5. What are passive Components?

Passive Components: Electrical and electronic circuits consist of connecting together many different components to form a complete and closed circuit. The three main passive components used in any circuit are the: Resistor, the Capacitor and the Inductor. All three of these passive components have one thing in common, they limit the flow of electrical current through a circuit but in very different ways.

- Passive components consume electrical energy and therefore cannot increase or amplify the power of any electrical signals applied to them, simply because they are passive and as such will always have a gain of less than one.

6. Write Examples of passive components.

- The three basic passive electronic components are resistors, capacitors, and inductors. Other passive components include transformers, diodes, thermistors, varactors, transducers, and many other common components.

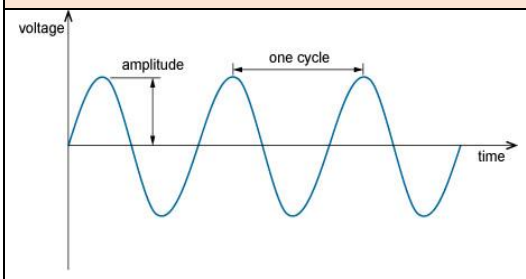
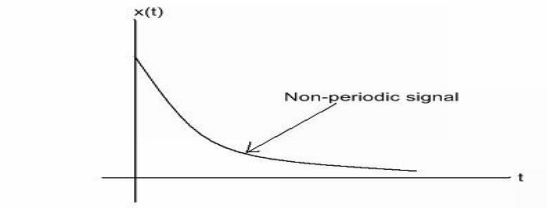
7. Define SCR and give applications of it.

- **Silicon Controlled Rectifiers or SCRs** for short is a type of power electronics switch. It has three terminals called Anode, Cathode, and Gate. By default, the switch is open and no current flows between the Anode and Cathode terminals of the SCR. When a small current is applied to the gate pin, the switch is closed and a large amount of current can be allowed to pass between the Anode and Cathode terminals.
- SCRs are mainly used in devices where the control of high power possibly coupled with high voltage, is demanded. Their operation makes them suitable for use in medium – to – high voltage AC Power control applications, such as lamp dimming, power regulators and motor control.

3 MARKS QUESTIONS

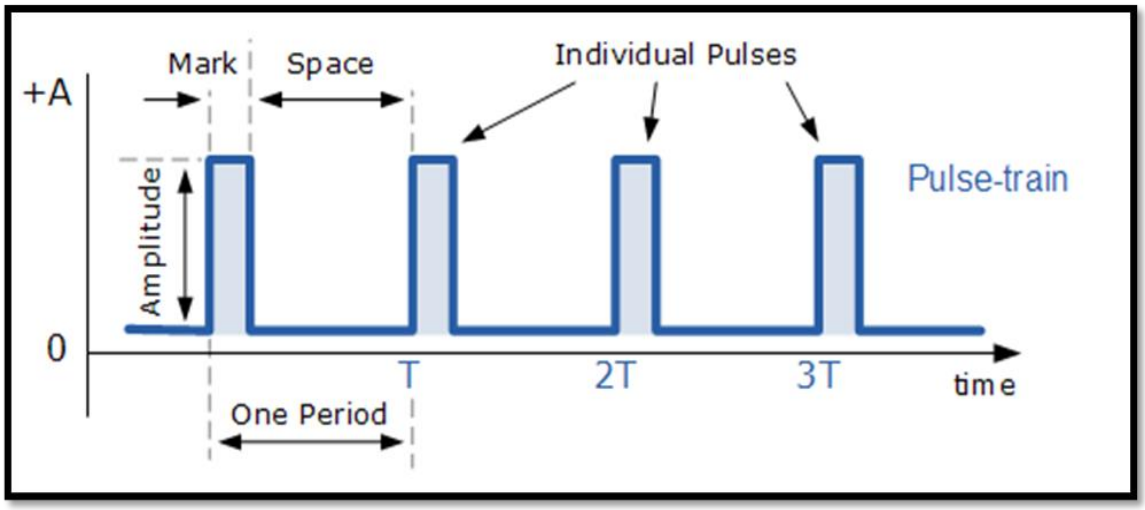
1. Give compression between periodical and non-periodical signals.

Periodic Signal	Aperiodic / Non periodic signal
A signal which repeats itself after a specific interval of time is called periodic signal.	A signal which does not repeat itself after a specific interval of time is called Aperiodic or Non periodic signal.
A signal that repeats its pattern over a period is called periodic signal.	A signal that does not repeat its pattern over a period is called Aperiodic or Non periodic signal.
They can be represented by a mathematical equation.	They cannot be represented by any mathematical equation.
Their value can be determined at any point of time.	Their value cannot be determined with certainty at any given point of time.
They are deterministic signals.	They are random signals.
Example: Sine wave, cosine, sawtooth	Example: Sound signals from radio, all

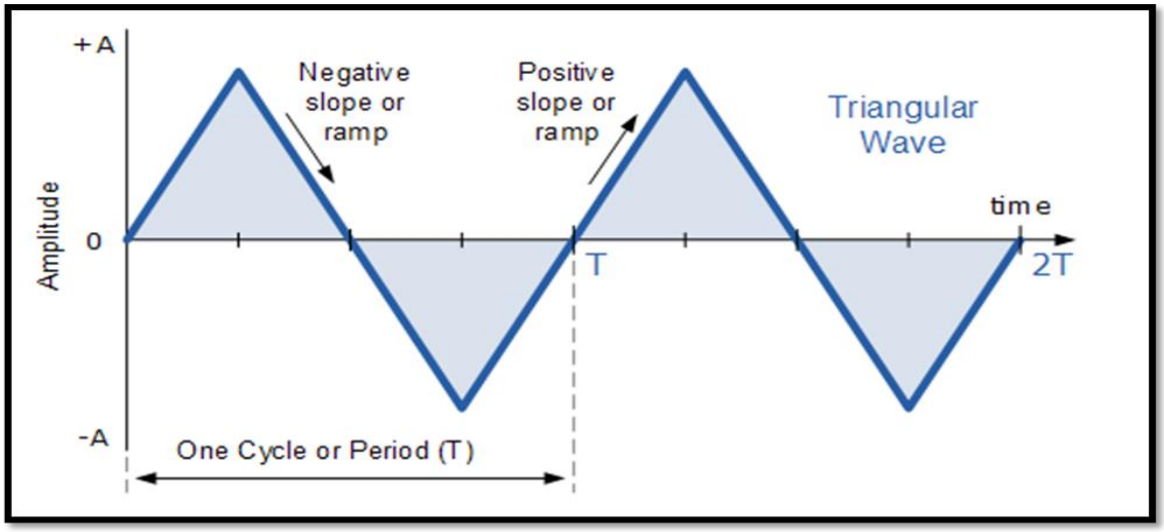
and square etc.	types of noise signals.
	

2. Explain pulse Signal and Triangular Signal.

- A Pulse Waveform or "Pulse-train" as they are more commonly called, is a type of non-sinusoidal waveform that is similar to the rectangular waveform we looked at earlier. The difference being that the exact shape of the pulse is determined by the "Mark-to-Space" ratio of the period and for a pulse or trigger waveform the Mark portion of the wave is very short with a rapid rise and decay shape as shown below.

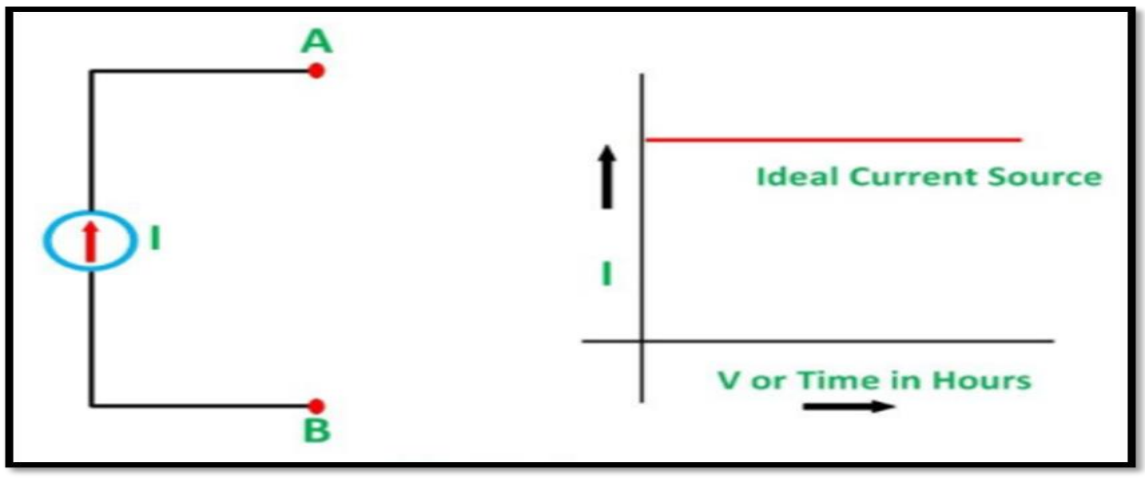


- Triangular Waveforms are generally bi-directional non-sinusoidal waveforms that oscillate between a positive and a negative peak value. Although called a triangular waveform, the triangular wave is actually more of a symmetrical linear ramp waveform because it is simply a slow rising and falling voltage signal at a constant frequency or rate. The rate at which the voltage changes between each ramp direction is equal during both halves of the cycle as shown below.



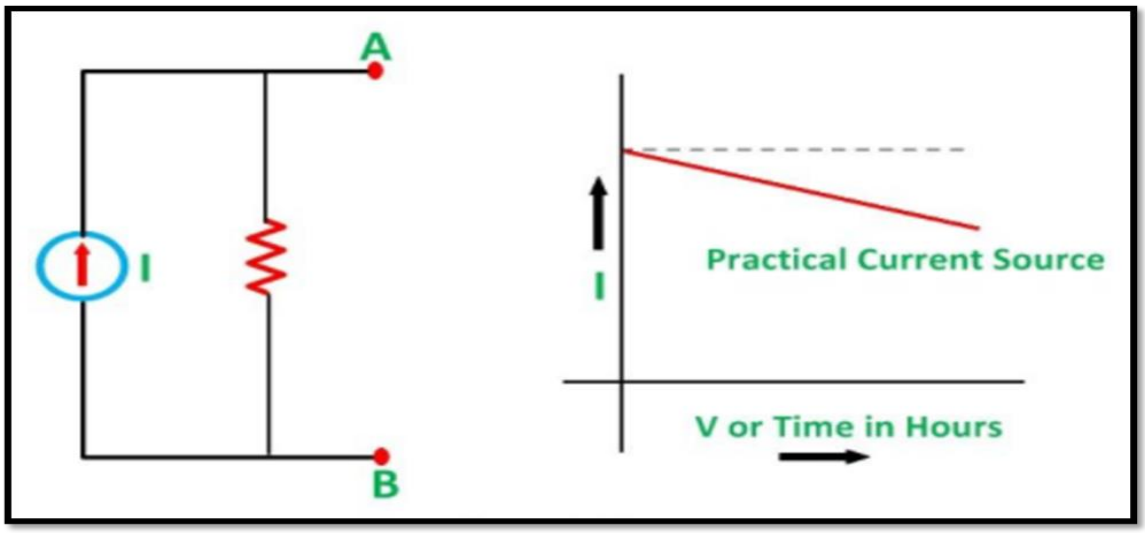
3. Draw and explain ideal and practical current source.

- **An ideal current source** is a two terminal device which supplies constant current irrespective of load resistance. The value of current will be constant with respect to time and load resistance. This means that the power delivering capability is infinite for this source.
- An ideal current source has infinite parallel resistance connected to it. Therefore, the output current is independent of voltage of the source terminals. No such current source exists in the world, this is just a concept. However, every current source is designed to approach closer to the ideal one.
- The internal resistance of current source is the value of resistance connected across its terminal. This internal resistance of ideal current source is infinite.



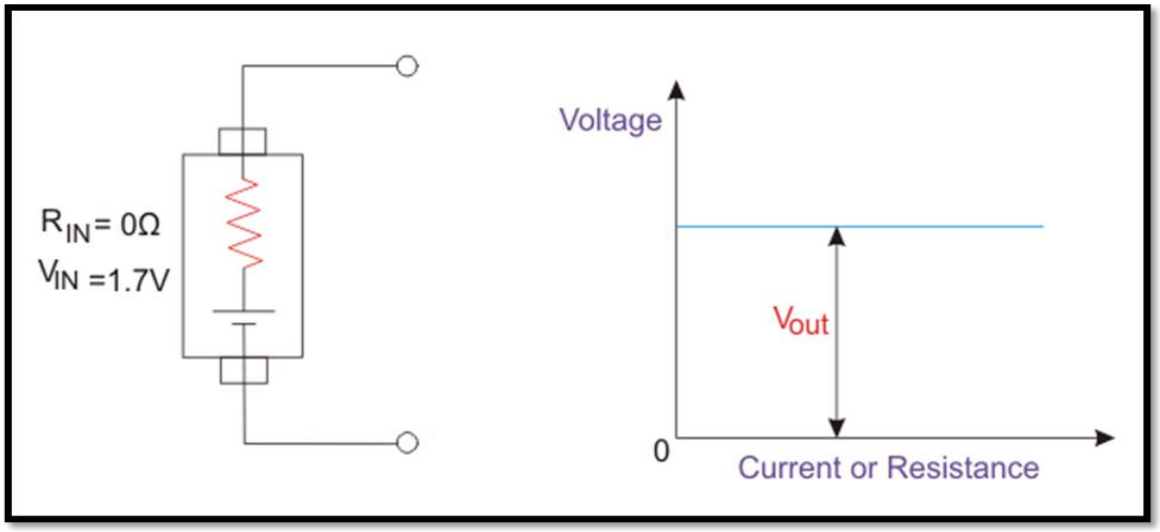
- **Practical current source** has resistance or impedance and it is connected to it. The current supplied by the current source decreases when the value of resistance or impedance increases.

- To better understand, let us consider a practical current source as shown below.

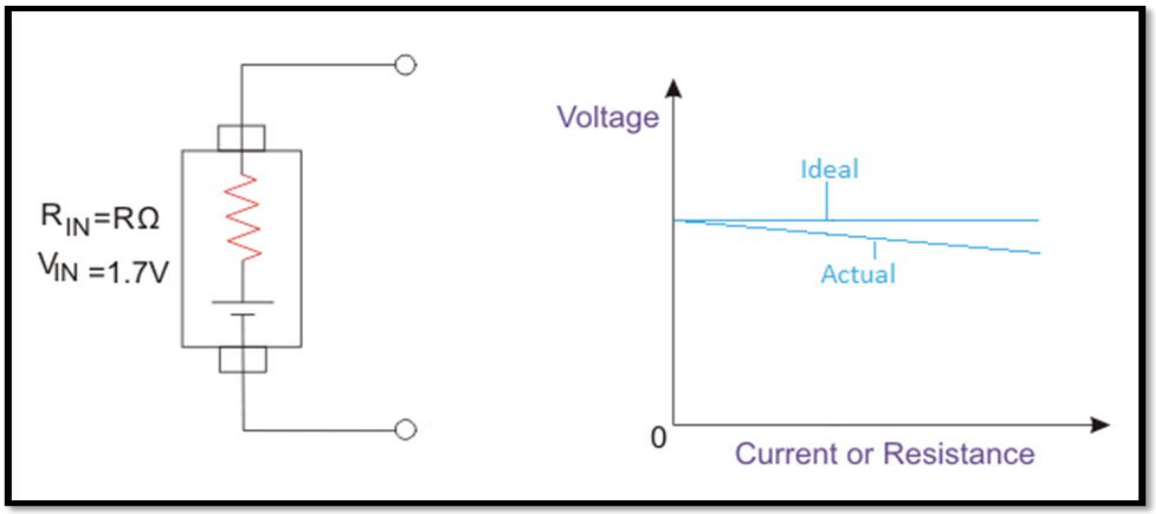


4. Draw and explain ideal and practical voltage source.

- **An ideal voltage source** is capable to maintain the constant voltage across its terminals. The voltage across the voltage source terminals remains constant and the voltage is independent of the current.
- The voltage across the terminals of an ideal voltage source remains constant and the voltage does not drop with increase in the circuit current. The voltage across an ideal voltage source with change in the circuit current.
- The voltage of an ideal voltage source remains constant if there does not happen voltage drop across the internal resistance of the voltage source. The voltage source has certain resistance which cause voltage drop across the internal resistance. An ideal voltage source must have zero internal resistance. In this condition, the voltage across the load will be equal to the voltage across the terminals of the voltage source.
- The ideal voltage source is shown in figure below.



- **practical voltage source** having an internal resistance of RΩ. Due to the internal resistance, there will be small amount of voltage drop in the R. So, the output voltage will be reduced to some volt from 1.7V.



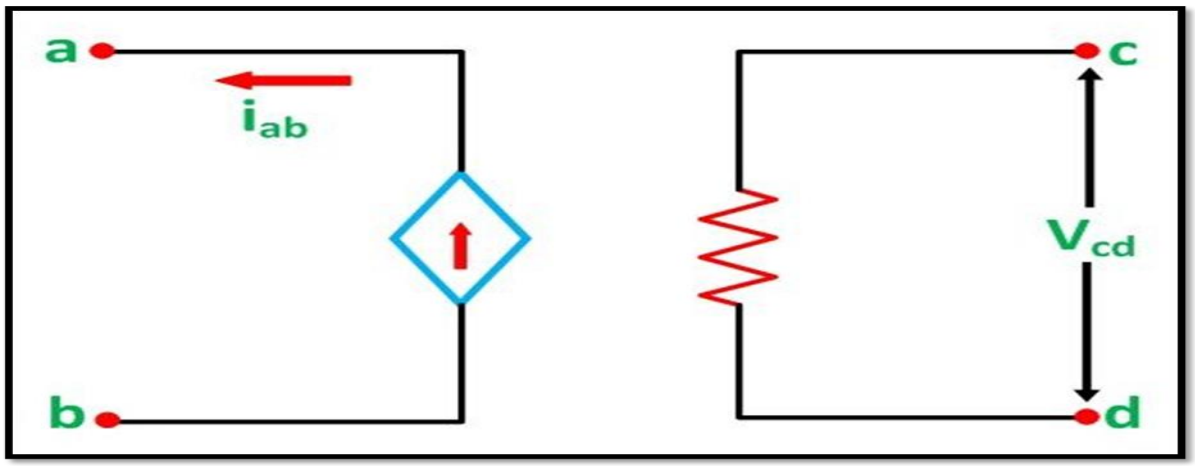
4-MARKS QUESTIONS

1. **Explain Voltage controlled current source (VCCS) and Current controlled voltage source (CCVS).**

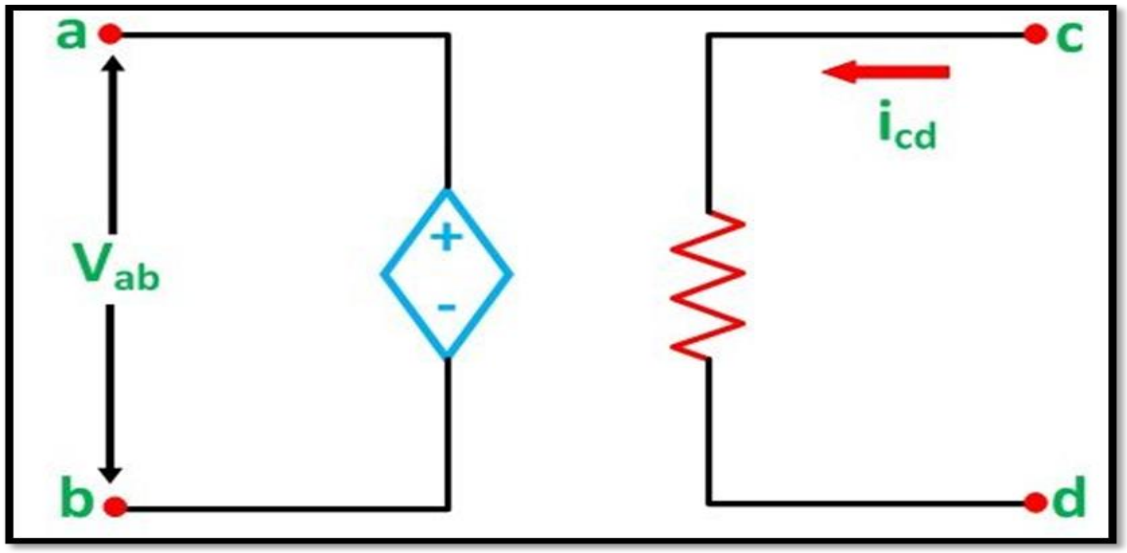
- **Voltage controlled current source (VCCS):** Voltage Controlled Current Source is that where the current is dependent or controlled by the changing of voltage elsewhere in the circuit. In short, it is known as VCCS. For dependent sources, sometimes voltage is controlled by current, and

sometimes current is controlled by voltage. According to those, there are four types of dependent sources. Anyway, the basic concept of the VCCS is, that voltage controls the output current. So, the output current Iout is proportional to the controlled input voltage Vin.

- The voltage-controlled current output is determined by the equation, IOUT = αVIN
- Here, IOUT = Output Current
- VIN = Input Voltage
- α(alpha) = Multiplying Constant, sometimes it is known as transconductance of the current source.



- **Current controlled voltage source (CCVS):** The current-controlled voltage source is that where the terminal voltage is dependent or controlled by the current flow elsewhere in the circuit. In short, it is known as CCVS. It is also a type of dependent source. In the previous article, we have learned about voltage control voltage source where the terminal is voltage dependent upon the voltage elsewhere in the circuit but here the concept is different. Here, changes in current flow elsewhere in the circuit can change the terminal voltage.
- Here, the current-controlled output voltage is determined by VOUT = ρIIN
- Here, VOUT = Output Dependent Voltage
- IIN = Input Current
- ρ(rho) = Multiplying constant or efficient of the voltage source. It is sometimes known as trans resistance.



2. Explain any two Passive components.

- **Resistance:** The property of material which oppose the flow of electrons is known as resistance of the circuit.
- It is denoted by letter R.
- Its unit is ohm (Ω).
- R= V/I
- **Resistance id depends upon below mentioned factors.**
  Length of material.
  Cross sectional area.
  Temperature.
  Type of Material.

- **Inductor:** Inductors much like conductors and resistors are simple components that are used in electronic devices to carry out specific functions. Normally, inductors are coil-like structures that are found in electronic circuits. The coil is an insulated wire that is looped around the central core.
- Inductors are mostly used to decrease or control the electric spikes by storing energy temporarily in an electromagnetic field and then releasing it back into the circuit.
- An inductor is a passive component that is used in most power electronic circuits to store energy in the form of magnetic energy when electricity is

applied to it. One of the key properties of an inductor is that it impedes or opposes any change in the amount of current flowing through it. Whenever the current across the inductor changes it either acquires charge or loses the charge in order to equalize the current passing through it. The inductor is also called a choke, reactor or just coil.

- The S.I. unit of inductance is henry (H) and when we measure magnetic circuits it is equivalent to weber/ampere. It is denoted by the symbol L.