IIT-JEE / MEDICAL

PHYSICS

KEY TERMS

CURRENT ELECTRICITY

By

BHARAT BHUSHAN @ B. K. NAL
Assistant Professor (Computer Science)
Director, BSTI, Kokar

&

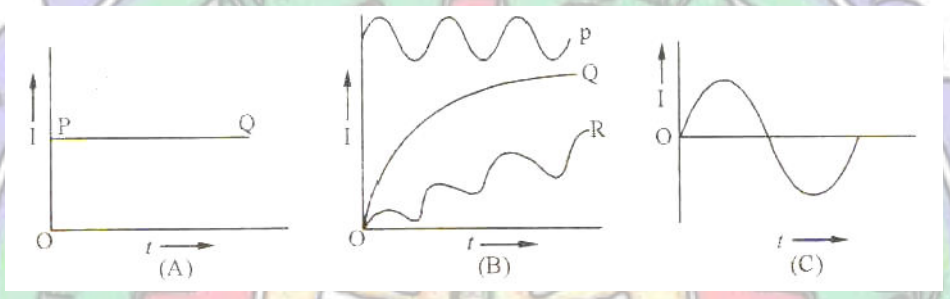
SUPRIYA BHARATI
Assistant Professor (Computer Science)
Asst. Director, BSTI, Kokar

Buddha Science & Technical Institute
Kokar, Ranchi-834001, Jharkhand, India
www.bharatsir.com

1. **Electric Current (I).** It is defined as quantity of charge flowing through any cross-section of a substance in a unit time.

   OR

   It is defined as the rate of flow of charge through any cross section of a substance.
2. **Ampere (A).** Current through a conductor is said to be one **ampere** if one coulomb of charge flows any cross-section of the conductor in one second.
3. **Steady or Smooth Direct Current (D.C.).** An electric current is said to be steady direct current if its magnitude and direction do not change with time (Figure A).
4. **Varying Direct Current (D.C.).** An electric current is said to be varying direct current if its magnitude changes with time and polarity remains same (Figure B).
5. **Alternative Current (A.C.).** An electric current is said to be alternating if its magnitude changes with time and polarity (i.e. + or-) reverses periodically (Figure C).



6. **Current Density (J).** It is defined as the amount of current flowing per unit area of the conductor held perpendicular to the direction flow of current.
7. **Current Carriers.** The charged particles which constitute an electric current in solids, liquids or gases are known as current carriers.
8. **Electrolytes.** The liquids which conduct electricity by dissociating into ions are called electrolytes. e.g. $CuSO_4$ solution, $AgNO_3$ solution, NaCl solution, H_2SO_4 etc.
9. **Drift Velocity.** It is defined as the average velocity with which free electrons in a conductor get drifted in a direction opposite to the direction of the applied electric field.
10. **Relaxation Time or Mean free time (τ).** The small interval of time between two successive collisions of electrons and ions in the lattice of a substance is called **relaxation time** or **mean free time**.
11. **Mobility (μ).** It is the ratio of the drift velocity (υ_d) of current carrier and the applied electric field (E)
12. **Ohm's Law.** According to this law, the potential difference (V) across the ends of the conductor is proportional to the current (I) flowing through it, provided the physical

conditions (like temperature, pressure, strain etc.) of the conductor remain unchanged.

13. **Ohmic Circuit Elements.** The circuit elements which strictly obey Ohm's law are known as ohmic circuit elements e.g. metals.
14. **Non-Ohmic Circuit Elements.** The circuit elements which do not strictly obey Ohm's law are known as **non-ohmic** circuit elements e.g. vacuum tubes, semiconductor diodes, transistors, thermistors etc.
15. **Electrical Resistance**. Resistance of a conductor is the opposition offered to the flow of electric current in the conductor.

Or

Resistance is defined as the ratio of the potential difference across the ends of the conductor to the current flowing through it.

16. **Ohm (Ω).** Resistance of a conductor is the conductor is said to be 1 ohm, if current of 1 A flows through it when potential difference of 1 V is applied across it.
17. **Resistor.** It is an electrical circuit component which opposes the flow of current in that circuit.
18. **Resistivity (Specific Resistance).** Resistivity (i.e. Specific resistance) of a material is equal to the resistance of the unit cube of the substance.
19. **Temperature Coefficient of resistance (α).** It is defined as the change in resistance per unit original resistance per degree rise in temperature.
20. **Thermistor.** It is a highly temperature dependent resistor usually made up of semi-conductor materials. **Temperature coefficient of resistivity of a thermistor** is very high and **resistance** of a thermistor changes very rapidly with change in temperature.
21. **Conductance.** It is given by the inverse of the resistance of a substance.
22. **Conductivity.** It is given by the inverse of the resistivity of a substance.
23. **Super-conductivity.** The property by virtue of which a metal, alloy oxide or a poor conductor shows almost zero resistance at a very low temperature is called **Super conductivity**.

Transition Temperature (T_c). The temperature below which a material becomes Super conductor is called **Transition temperature or Critical temperature**.

24. **Equivalent resistor.** A single resistor which draws the same current as the given combination of resistors (series or parallel) when the same potential difference is applied across its end points is called **equivalent resistor** or **effective resistor** or **net resistor** or **total resistor**.

25. **Series combination of resistors.** Two or more resistors are said to be connected in series if they are connected one after the other such that the **same current** flows through all the resistors when some potential difference is applied across the combination.
26. **Parallel Combination of Resistors.** Two or more resistors are said to be connected in parallel if one end of a resistor is connected to one end of the other resistor and the second end of the first resistor is connected to second end of the other resistor such that **same potential difference** exists across each resistor.
27. **A Cell.** A cell is a device which provides the necessary potential difference to a electric circuit to maintain a continuous flow of current in it.
28. **E.M.F. (Electromotive force).** It is defined as the potential difference between its terminals in an open circuit or simply as open circuit voltage of a cell.
29. **Terminal Potential Difference.** It is defined as the potential difference between terminals of a cell operating in a closed circuit.
30. **Internet Resistance of a Cell.** It is defined as the opposition offered by a cell to the flow of current through it. It is denoted by r and mainly depends on the nature of electrolytes and electrodes of a cell.
31. **Kirchhoff's First Law (The Junction Law or Current Law).** It states that the sum of the currents entering a junction must be equal to the sum of currents leaving that junction.

    Or

    The algebraic sum of currents meeting at a junction in a closed electrical circuit is zero. i.e.

    $$\Sigma I = 0$$

32. **Kirchhoff's Second Law (The Loop Law or Kirchhoff's voltage Law).** It states that the algebraic sum of the products of the currents and resistances in any closed loop of an electrical circuit is equal to the algebraic sum of the e.m.f.'s acting in that loop.

    i.e. $$\Sigma IR = \Sigma E$$

33. **Wheatstone bridge.** It is an arrangement of four resistors to measure one unknown resistance out of these in terms of remaining three known resistances.
34. **Potentiometer.** It is a device having a slide wire and jockey commonly used for comparing e.m.fs. and to measure internal resistance of cells.

35. **Electric power.** (i) In general, it can be defined as the rate of doing electrical work. (ii) From Joule's law, **electric power** (P) can be defined as the rate heat produced due to current (I) flowing through a conductor when some potential difference (V) is applied across it. (iii) **Electric power** is simply defined as the product of the applied voltage and current flowing through the circuit.

    i.e. $$P = VI$$

    (iv) **Electric power** (P) is also defined as the energy liberated or dissipated per unit time due to resistance R of an electric device when current I flows through it.

36. **Watt.** Electric power is said to be 1 watt if 1 ampere current flows when a potential difference of 1 volt is applied.

37. **Electric Energy.** It is the capacity of doing electrical work.

    Or

    The work done by a source to maintain a current in an electrical circuit is known as electric energy.