

Chapter One

Basic Concepts

- This course basically deals with the analysis of electric circuits.
- The most basic quantity used in the analysis of electrical circuits is the electric charge (electron).

Basic Quantities

(1) Electron :electron is a mobile charge carrier.

- The electron is measured in coulomb [C]
- $e = 1.6 \times 10^{-19} \text{ C}$
- Multiple of electrons constitute charge (q).

- The movement of charge (q) over time causes current.

(2) Current :

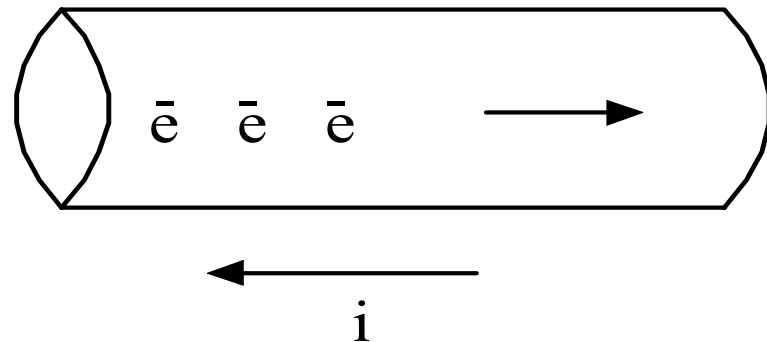
the time rate of change of charge produces an electrical current

$$i(t) = \frac{dq(t)}{dt} \quad \text{Or} \quad q(t) = \int_{\tau = -\infty}^t i(\tau) d\tau$$

- the electric current is measured in Amper [A]

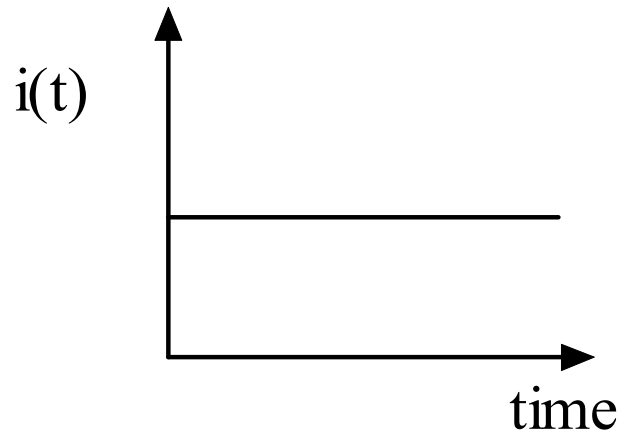
$$1 \text{ A} = 1 \text{ C} / 1 \text{ sec}$$

- .current convention.

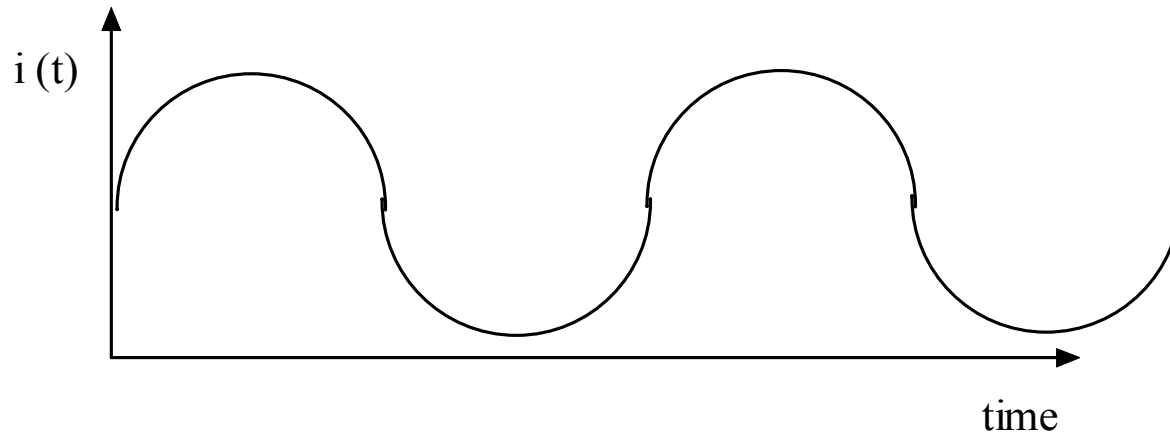


There are 2 types of currents

1. Direct current (DC)



2. Alternating current (AC)



(3) Voltage :

The voltage is defined as the work or energy (in Joules) required per unit charge to move a test charge through an element

$$V = \frac{W}{q}$$

And

$$1V = \frac{1 \text{ J}}{1 \text{ C}}$$

- Since we are dealing with a changing charge and energy, we have

$$v = \frac{dw}{dq}$$

(4) Power :

Power is the time rate of change of energy.

$$P(t) = \frac{dw(t)}{dt}$$

$$P(t) = \frac{dw(t)}{dt} = \frac{dw(t)}{dq} \cdot \frac{dq}{dt}$$

$$P(t) = V(t) i(t)$$

• The unit of power is Watt [W].

• **1 W = 1 V * 1A**

(5) Energy: energy can be expressed as

$$w(t) = \int_{t_1}^{t_2} p(t) dt = \int_{t_1}^{t_2} v(t) i(t) dt$$