ENGINEERING

Engineering is the application of scientific, economic, social, and practical knowledge in order to invent, design, build, maintain, research, and improve structures, machines, devices, systems, materials, and processes.

Electrical engineering is a field of engineering that generally deals with the study and application of electricity, electronics, and electromagnetism.

Or it is the branch of engineering in which we study about the low frequency and high voltage appliance**.**

Electronics Engineering is the branch of engineering in which we study about the high frequency low voltage, semi-conductor material is the key of electronics branch.

SYLLABUS

Unit-I

D C Circuit Analysis and Network Theorems:

Unit-II

Steady- State Analysis of Single Phase

AC Circuits:

Unit-III

- Three Phase AC Circuits:
- Measuring Instruments:

Unit-IV

- Introduction to Ear thing and Electrical Safety:
- Magnetic Circuit:
- Single Phase Transformer:

Unit-V

- Electrical Machines:
- DC machines:
- Three Phase Induction Motor:
- Single Phase Induction motor
- Three Phase Synchronous Machines

UNIT-1 D C CIRCUIT ANALYSIS AND NETWORK THEOREMS:

- **Circuit Concepts:**
- **Concepts of network, Active and passive elements, Voltage and current sources,**
- **Concept of linearity and linear network, Unilateral and bilateral elements,**
- **R, L and C as linear elements, Source transformation**
- **Kirchhoff’s laws; Loop and nodal methods of analysis;**
- **Star-delta transformation**
- **Network theorems:**
- **Superposition theorem,**
- **The venin's theorem,**
- **Norton’s theorem,**
- **Maximum Power Transfer theorem (Simple numerical problems)**

FUNDAMENTAL ELECTRICAL CONCEPTS

CHARGE, CURRENT, VOLTAGE, POWER AND ENERGY

ELECTRIC CHARGE (Q)

Characteristic of subatomic particles that determines their electromagnetic interactions

An electron has a $-1.602 \cdot 10^{-19}$ Coulomb charge

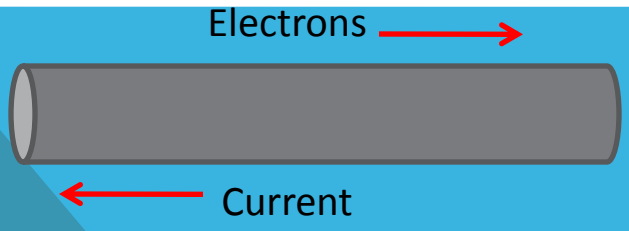
The rate of flow of charged particles is called current

CURRENT (I)

Current = (Number of electrons that pass in one second) · (charge/electron)

- -1 ampere = ($6.242 \cdot 10^{18}$ e/sec) ·($-1.602\ 10^{-19}$Coulomb/e)
- Notice that an ampere = Coulomb/second

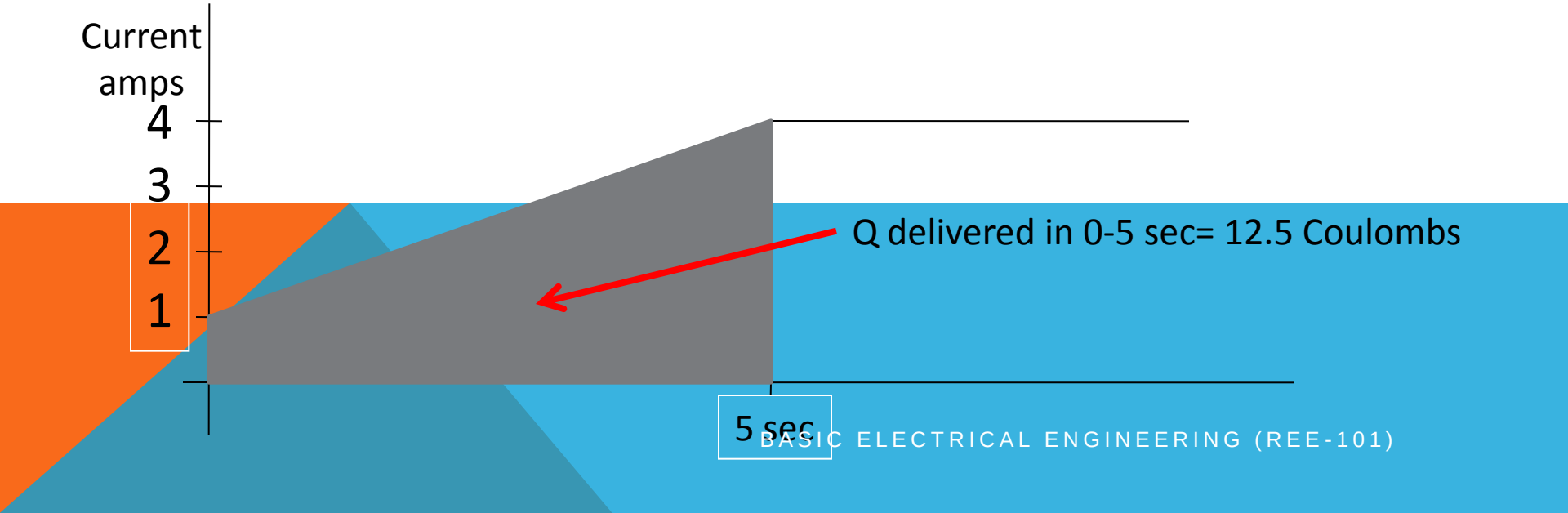
The negative sign indicates that the current inside is actually flowing in the opposite direction of the electron flow



CURRENT

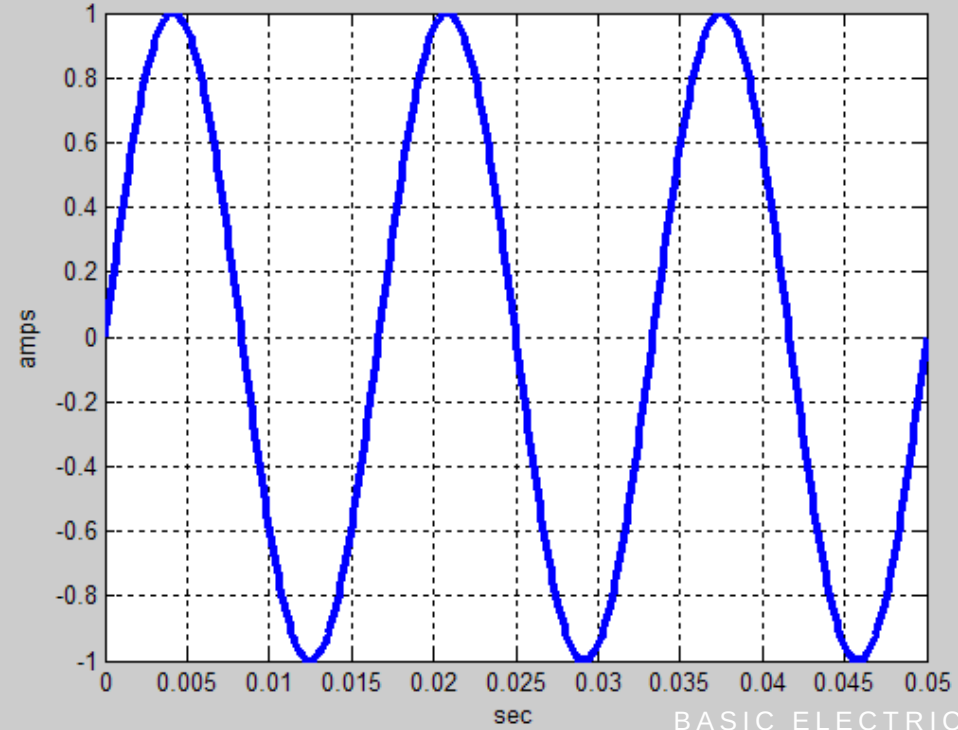
i = dq/dt – the derivitive or slope of the charge when plotted against time in seconds

Q = ∫ i · dt – the integral or area under the current when plotted against time in seconds



AC AND DC CURRENT

- DC Current has a constant value
- AC Current has a value that changes sinusoidally



- Notice that AC current changes in value and direction
- No net charge is transferred

WHY DOES CURRENT FLOW?

A voltage source provides the energy (or work) required to produce a current

- Volts = joules/Coulomb = dW/dQ

A source takes charged particles (usually electrons) and raises their potential so they flow out of one terminal into and through a transducer (light bulb or motor) on their way back to the source's other terminal

VOLTAGE

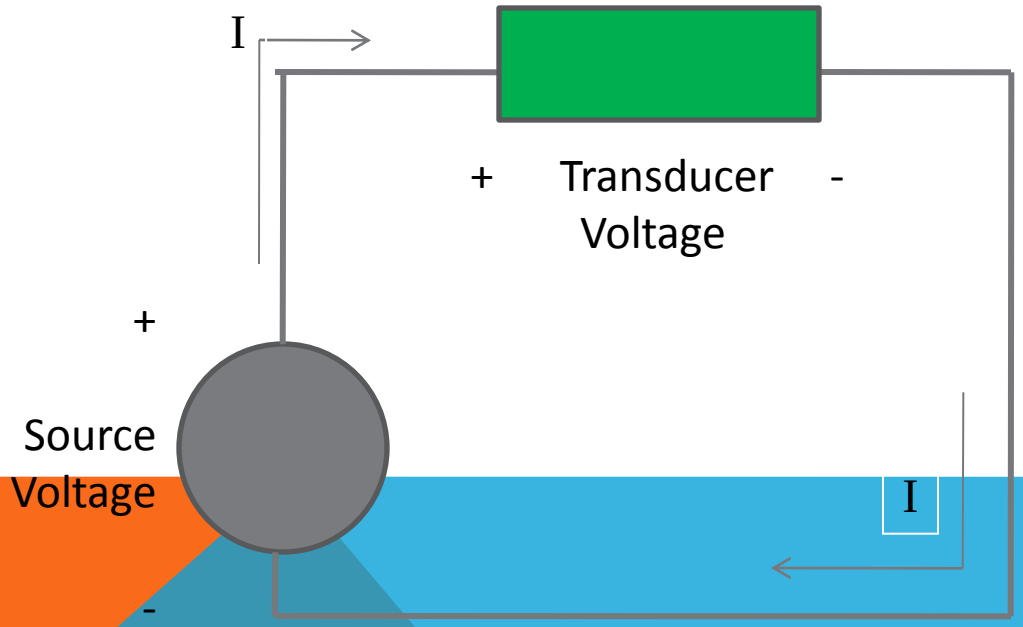
Voltage is a measure of the potential energy that causes a current to flow through a transducer in a circuit

Voltage is always measured as a difference with respect to an arbitrary common point called ground

Voltage is also known as electromotive force or EMF outside engineering

A CIRCUIT

Current flows from the higher voltage terminal of the source into the higher voltage terminal of the transducer before returning to the source



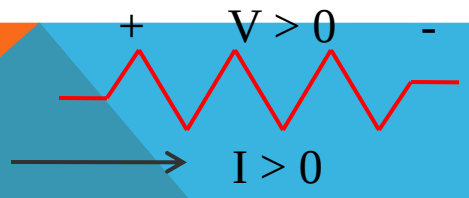
- The source expends energy & the transducer converts it into something useful

PASSIVE DEVICES

A passive transducer device functions only when energized by a source in a circuit

- Passive devices can be modeled by a resistance

Passive devices always draw current so that the highest voltage is present on the terminal where the current enters the passive device



- **Notice that the voltage is measured across the device**
- **Current is measured through the device**

ACTIVE DEVICES

Sources expend energy and are considered active devices

Their current normally flows out of their highest voltage terminal

Sometimes, when there are multiple sources in a circuit, one overpowers another, forcing the other to behave in a passive manner

POWER

The rate at which energy is transferred from an active source or used by a passive device

P in watts = dW/dt = joules/second

P= V·I = dW/dQ · dQ/dt = volts · amps = watts

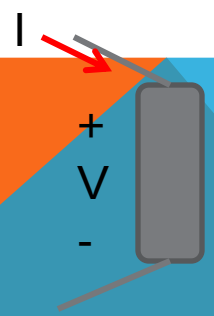
W = ∫ P · dt – so the energy (work in joules) is equal to the area under the power in watts plotted against time in seconds

CONSERVATION OF POWER

Power is conserved in a circuit - $\sum P = 0$

We associate a positive number for power as power absorbed or used by a passive device

A negative power is associated with an active device delivering power



If I=1 amp
V=5 volts
Then passive
P=+5 watts
(absorbed)

If I= -1 amp
V=5 volts
Then active
P= -5 watts
(delivered)

If I= -1 amp
V= -5 volts
Then passive
P=+5 watts
(absorbed)