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Content engagement

CSE 123 (3.0 CREDITS):

Basic Electrical Engineering

Book Reference
Introductory Circuit Analysis by R. L. Boylestad

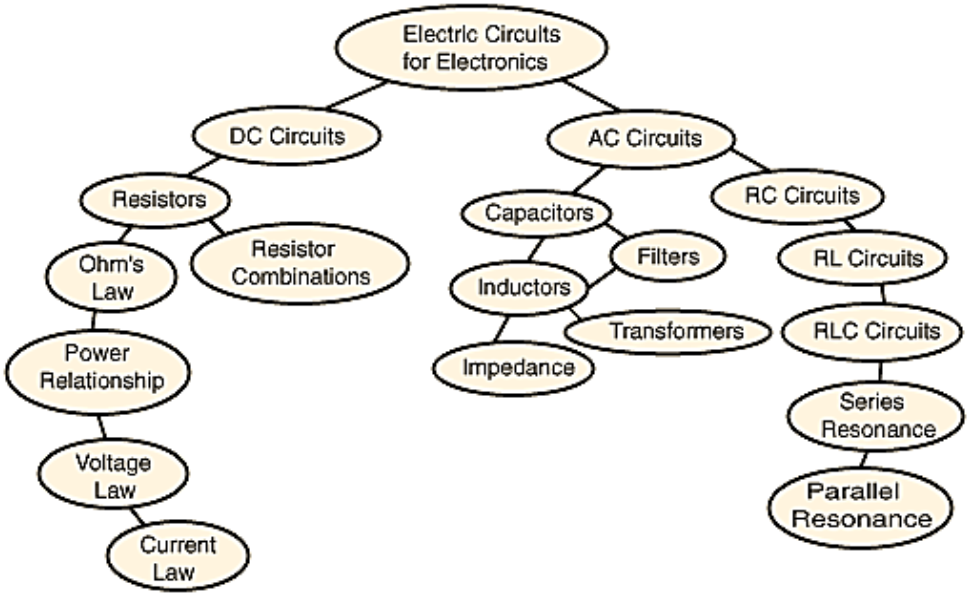
CSE 123 (3.0 CREDITS):

Basic Electrical Engineering

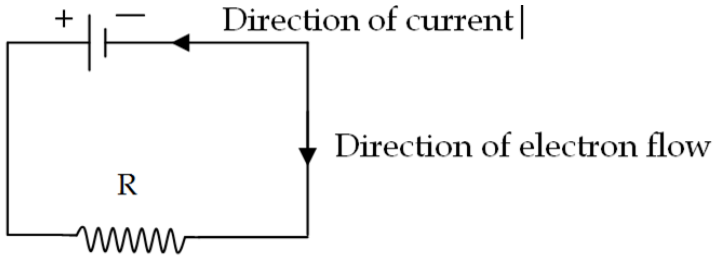
Topic 1:	Introduction to Electrical circuits, Circuit elements, Current, Voltage, Resistance, Laws of resistance, Ohm's Law, Open-short circuit, Source conversion, Polarities.
Topic 2:	Equivalent resistance, voltage-current divider rule, delta-star transformations.
Topic 3:	Kirchhoff's laws, Relative mathematical problems.
Topic 4:	Mesh analysis.
Topic 5:	Nodal Analysis.
Topic 6:	Thevenin' theorem & Norton's theorem.
Topic 7:	Capacitance & Inductance.
Topic 8:	Alternating Circuit (AC) fundamentals.

Background

Basic concept of Electrical circuits



SIMPLE ELECTRIC CIRCUIT:



Voltage, also called electromotive force, is an electrical potential difference in charge between two points in an electrical field. Voltage makes electric charges move. The unit for electrical potential difference, or voltage, is the volt and it expressed as **V**.

Current is the flow of electrons. In other words, current is the rate at which electric charge flows past a point in a circuit. The unit of current is ampere and is denoted as **A**. Direction of current is the opposite of the flow of the current.

Flow of current $+ \rightarrow -$

Flow of electron $- \rightarrow +$

Resistance is the property of the substance due to which it opposes or restricts the flow of electricity or electrons through it. Its unit is ohm and is expressed as **Ω**.

Voltage is the cause and current is its effect

LAWS OF RESISTANCE:

It varies directly as its length, *l*

It varies inversely as the cross section, A of the conductor

It depends on the nature of the material

It depends on the temperature of the material.

So $R \propto l/A$

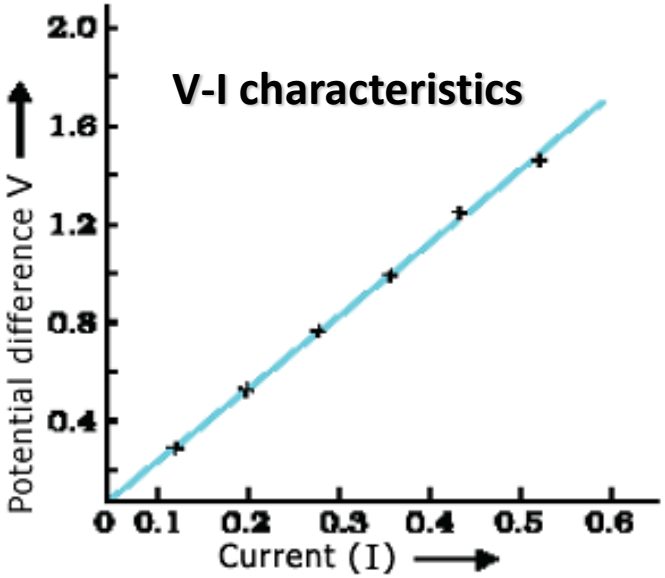
or $R = \rho\, l/A$

Resistivity (ρ) is a constant depending on the nature of the conductor. Its unit is ohm-meter (Ω-m).

Ohm's Law:

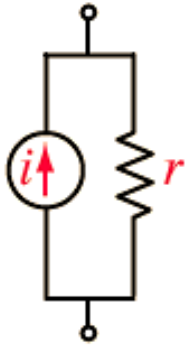
The ratio of potential difference (V) between any two points on a conductor to the current (I) flowing between them, is constant, provided the temperature of the conductor doesn't change.

$V \propto I \quad or \quad \frac{V}{I} = \text{constant} \quad \text{or} \quad \frac{V}{I} = R \quad \text{or} \quad V = IR$



An ideal voltage source has zero internal resistance so that changes in load resistance will not change the voltage supplied.

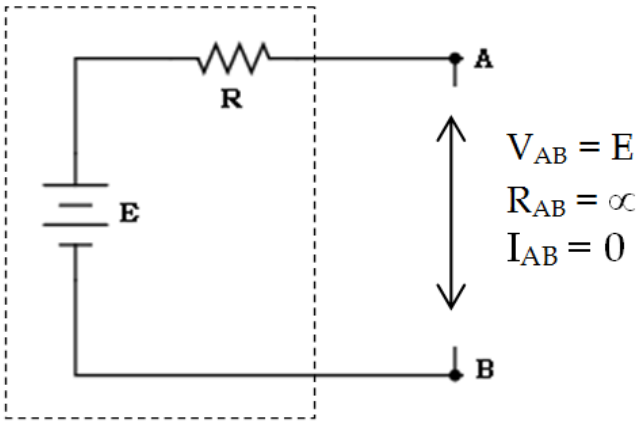
An ideal current source has infinite internal resistance so that changes in load resistance will not change the current supplied.



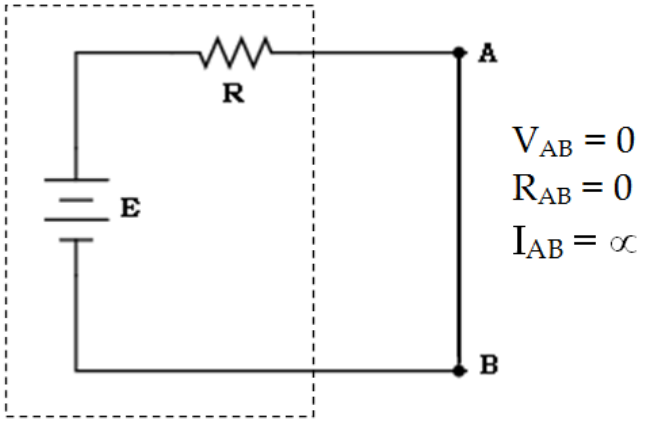
$e = i\,r$

A source may be represented either as a current source or a voltage source. The two types of representations have the same resistance and are related by the above relationship.

OPEN & SHORT CIRCUIT:

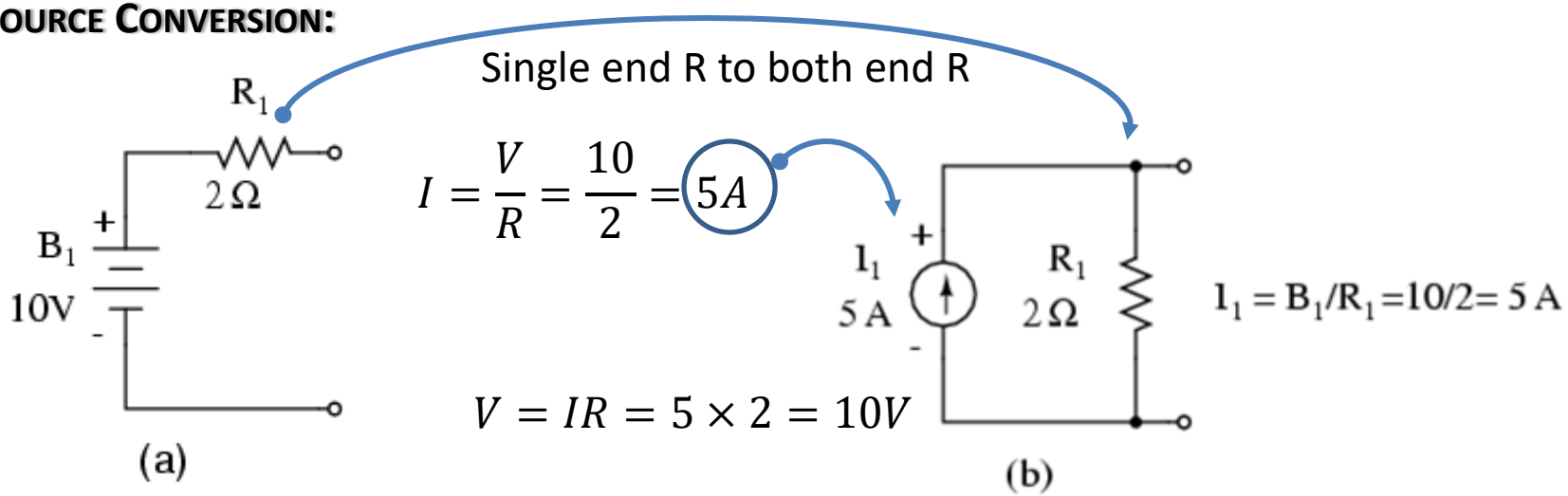


(a) Open circuit

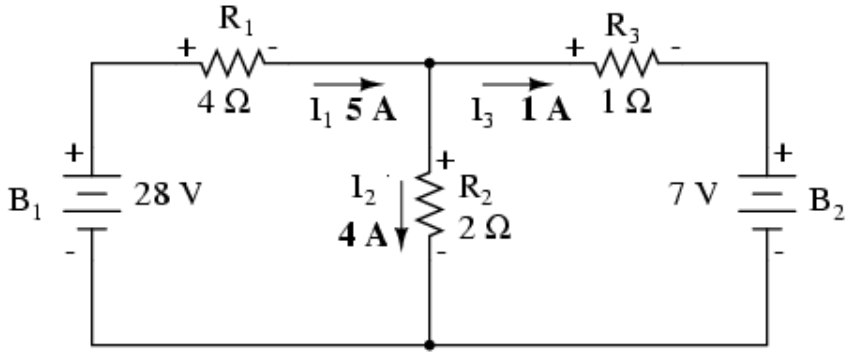


(b) Short circuit

SOURCE CONVERSION:



POLARITIES OF VOLTAGES & CURRENT DIRECTIONS:



With 28 V battery	With 7 V battery	With both batteries
6 A → I_{R1}	1 A ← I_{R1}	**5 A** → I_{R1} *6 A - 1 A = 5 A*
I_{R2} 2 A ↓	I_{R2} 2 A ↓	I_{R2} **4 A** ↓ *2 A + 2 A = 4 A*
4 A → I_{R3}	3 A ← I_{R3}	**1 A** → I_{R3} *4 A - 3 A = 1 A*