# SNS COLLEGE OF ENGINEERING

**Coimbatore-35**
**An Autonomous Institution**
Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade Approved by AICTE,
New Delhi & Affiliated to Anna University, Chennai

## DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

I ECE / II SEMESTER

## Unit 2 –NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS

Topic 1 –Network reduction: voltage and current division,

# Introduction:

- Kirchhoff's Voltage Law states that that "The algebraic sum of all the voltages in a loop must equal zero". A practical application of this law is the voltage divider rule.
- Kirchhoff's Current Law states that"The algebraic sum of all currents entering and exiting a node must equal zero." A practical Application of this law is current divider rule.
- A parallel circuit acts as a current divider as the current divides in all the branches in a parallel circuit.
- A series circuit act as a voltage divider as the voltage divides in all the branches in a series circuit.

# Voltage Divider Rule:

- Calculate equivalent resistance.
- In series:

$$R_{eq} = R_1+R_2+R_3+.....R_n$$

- Calculate current by applying Ohm's Law($I=V/R_{eq}$).
- Current remains same in series

$$I=I_1=I_2=I_3$$

- As voltage divides in series, So Voltage Divider Rule states that;

$$V_x = V(R_x/ R_x+R_y+R_z)$$

# Example:

- $V_1 = (5/5+10+7.5) \times 45$

  $= 5/22.5 \times 45$

  $V_1 = 10V$

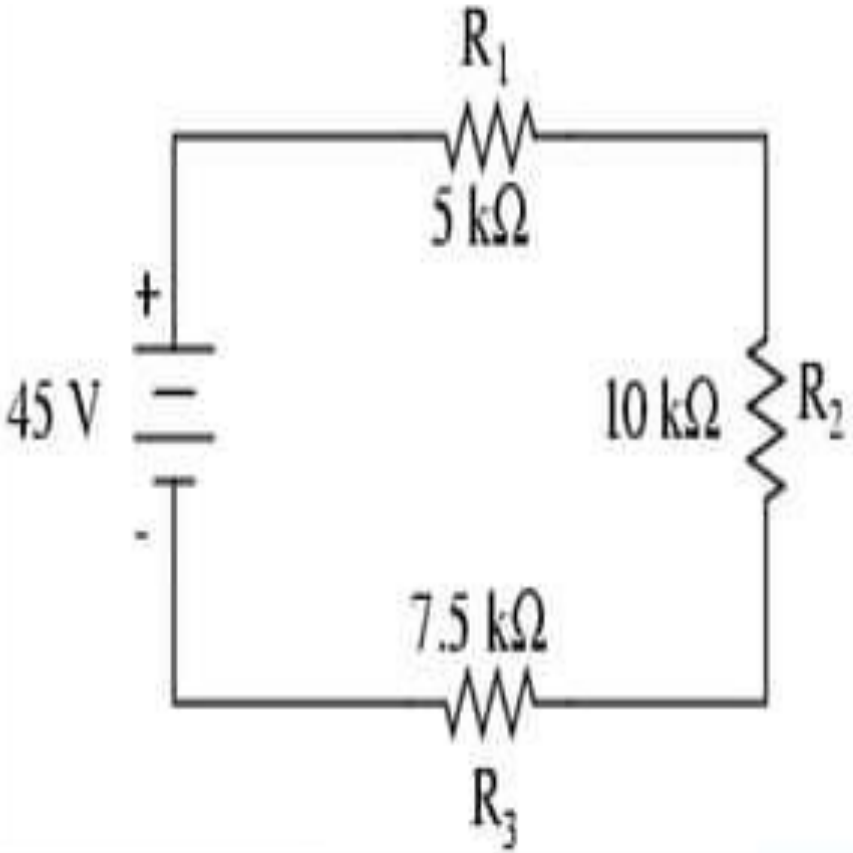
- $V_2 = (10/5+10+7.5) \times 45$

  $= 10/22.5 \times 45$

  $V_2 = 20V$

- $V_3 = (7.5/5+10+7.5) \times 45$

  $V_3 = 15V$



# Application:

- The voltage divider is used only there where the voltage is regulated by dropping a particular voltage in a circuit. It mainly used in such systems where energy efficiency does not necessary to be considered seriously.
- In our daily life, most commonly the voltage divider is used in potentiometers.
- The best examples for the potentiometers are the volume tuning knob attached to our music systems and radio transistors, etc

# Current Divider Rule:

- Calculate equivalent resistance.
- In parallel circuit;

$$R_{eq} = R_1R_2R_3/R_2R_3+R_1R_3+R_2R_1$$

- Calculate current by applying Ohm's Law($I=V/R_{eq}$).
- As voltage remains same in parallel circuit;

$$V_1=V_2=V_3=V$$

- As current divides in parallel circuit,So according to current divider rule:

$$I_x=(R_t/R_x)\times I$$

# Example:

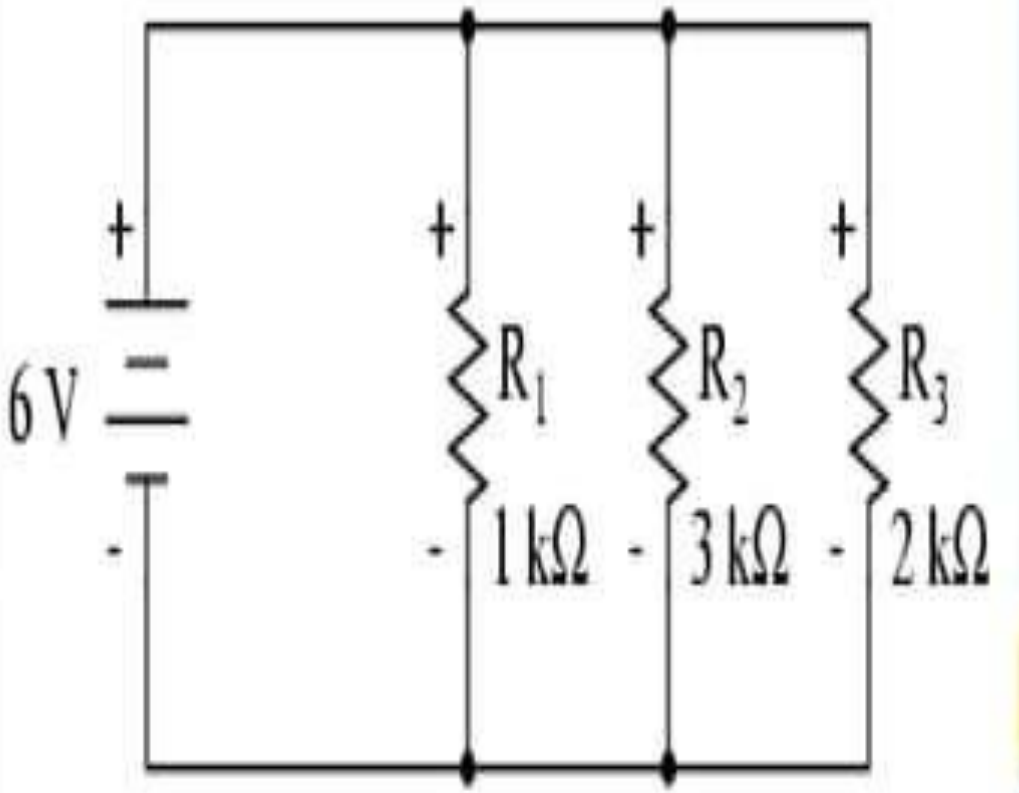
- $1/R_{eq}=1/R_1+1/R_2+1/R_3$
- $R_{eq}=0.54\Omega$
- $I_t=V/R_{eq}$

  $I_t=11.11A$
- $I_1=(R_t/R_1)\times I_t$

  $I_1=(0.54/1)\times 11.11$

  $I_1=6A$
- $I_2=(R_t/R_2)\times I_t$

  $I_2=2A$



# Method 2:

- $I_1=(R_2||R_3/R_1+R_2||R_3)\times I_t$

  $I_1=6A$
- $I_2=(R_1||R_3/R_2+R_1||R_3)\times I_t$

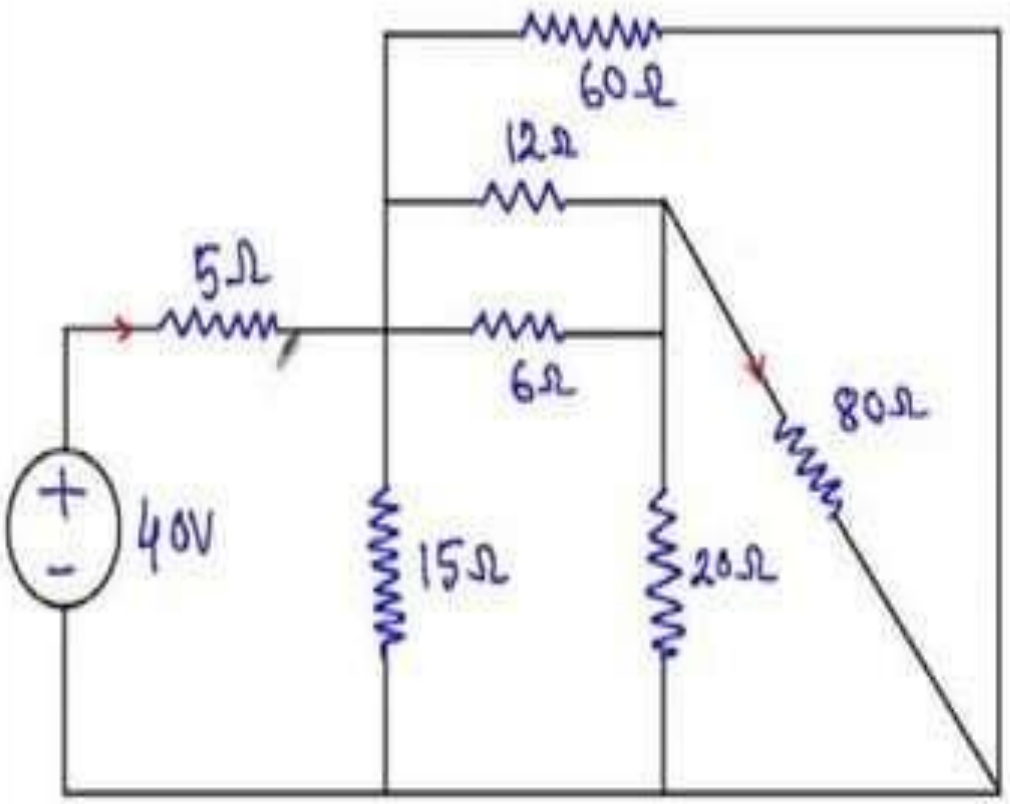
  $I_2=2A$
- $I_3=(R_1||R_2/R_3+R_1||R_2)\times I_t$

  $I_3=2.97A$

# Application:

- Current divider circuits also find application in electric meter circuits, where a fraction of measured current is desired to be routed through a sensitive detection device.
- Using the current divider formula, the proper shunt resistor can be sized to proportion just the right amount of current for the device in any given instance

# Complex Circuit:

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