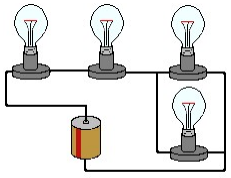
Class 08 – Series Parallel Circuits
Ohm's Law & Power Analysis



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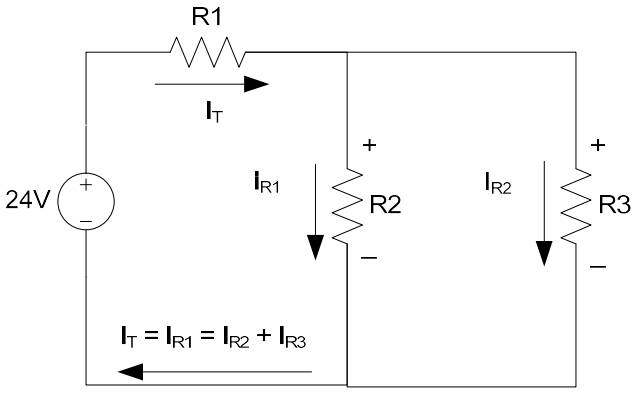
- Series Parallel Circuits
  - Any circuit having a both series and parallel connected components



- Series Parallel Circuits
  - Any circuit having a both series and parallel connected components
  - Characteristics
    - Series components may be in series with individual or combinations of components
    - Parallel components may be in parallel with individual or combinations of components

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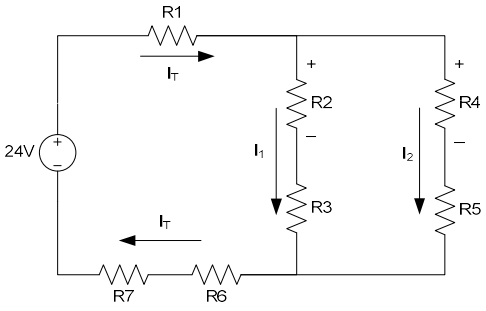
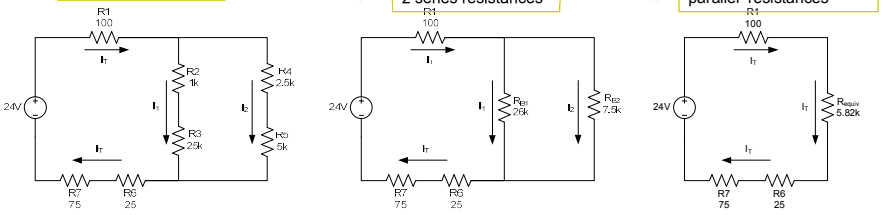
- Series Parallel Circuits
  - Identification
    - Series connected – common current path
    - Parallel connected – common supply voltage

1. Branch 1 - R2& R3 have a common current path, are in series with each other.
2. Branch 2 - R4 & R5 have a common current path, are in series with each other.
3. R1, R6 & R7 have a common current path, are in series with each other, and with parallel branches 1 & 2.

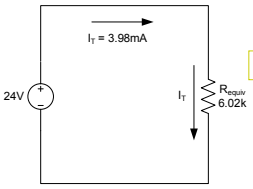


- Series Parallel Circuits
  - Total Resistance – Reduce & Redraw

Original Circuit → Combine branch 1 & 2 series resistances → Combine branch 1 & 2 parallel resistances



Combine series resistances → Find I_T using Ohm's Law

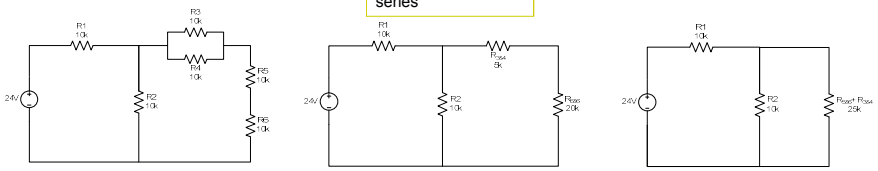


$$I_T = \frac{V_S}{R_T}$$

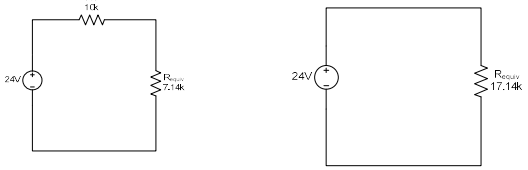
$$I_T = \frac{24V}{6.02k\Omega}$$

- Series Parallel Circuits
  - Sample Analysis – Equivalent Circuit

Original Circuit → Combine R3 & R4 parallel, R5 & R6 series → Combine $R_{3\&4}$ and $R_{5\&6}$

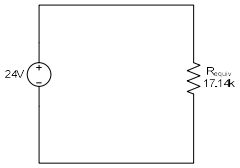


Combine final parallel resistances → Combine final series resistances

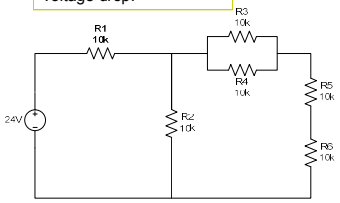


- Series Parallel Circuits
  - Sample Analysis – Voltage and Current

Equivalent Circuit → Ohm's Law → Apply I_T to R1 to find voltage drop. →



$$I_T = \frac{V_S}{R_T}$$
$$I_T = \frac{24V_S}{17.14k\Omega}$$
$$I_T = 1.40mA$$



→ Ohm's Law → Apply V_{R1} & KVL to find V_{R2} → Apply V_{R2} w Ohm's Law to find I_{R2}

$$V_{R1} = I_T \times R1$$
$$V_{R1} = 1.40mA \times 10k\Omega$$
$$V_{R1} = 14.0V$$

$$V_{R2} = V_S - V_{R1}$$
$$V_{R2} = 24V - 14.0V$$
$$V_{R2} = 10V$$

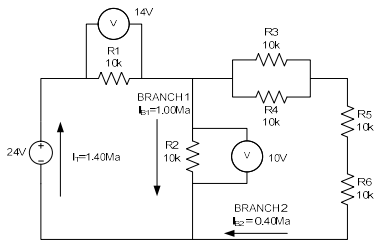
$$I_{R2} = \frac{V_{R2}}{R2}$$
$$I_{R2} = \frac{10V}{10k\Omega}$$
$$I_{R2} = 1.00mA$$

- Series Parallel Circuits
  - Sample Analysis – Voltage & Current

Apply V_{R2} w Ohm's Law to find I_{R2} → Kirchhoff's Current Law, I_T equals sum of branch currents → Label circuit diagram with new information →

$$I_{R2} = \frac{V_{R2}}{R2}$$
$$I_{R2} = \frac{10V}{10k\Omega}$$
$$I_{R2} = 1.00mA$$

$$I_T = I_{B1} + I_{B2}$$
$$I_{B2} = I_T - I_{B1}$$
$$I_{B2} = 1.40mA - 1.00mA$$
$$I_{B2} = 0.40mA$$



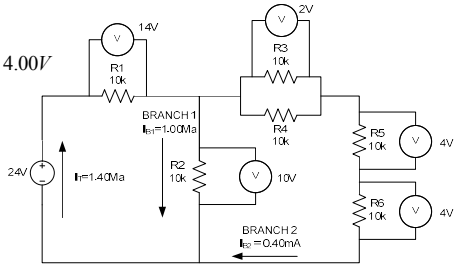
- Series Parallel Circuits
  - Sample Analysis – Voltage & Current

Apply Ohm's Law to find V_{R5} & V_{R6} → Kirchhoff's Voltage Law → Label circuit diagram with new information →

$$V_{R5} = I_{B2} \times R5$$
$$V_{R5} = 0.40mA \times 10k\Omega = 4V$$

$$V_{R6} = I_{B2} \times R6$$
$$V_{R6} = 0.40mA \times 10k\Omega = 4V$$

$$V_{3\&4} = V_{R2} - V_{R5} - V_{R6}$$
$$V_{3\&4} = 10.00V - 4.00V - 4.00V$$
$$V_{3\&4} = 2.00V$$



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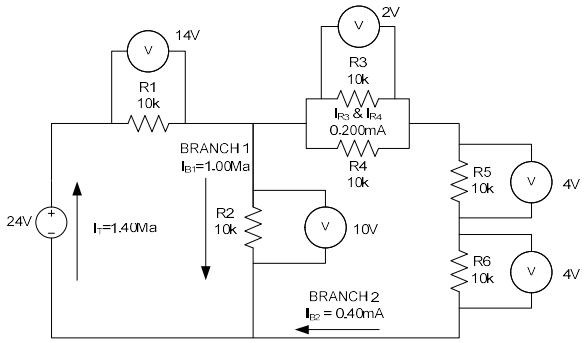
  - Sample Analysis – Voltage & Current

Ohm's Law → Label circuit diagram with new information

$$I_{R3} = I_{R4} = \frac{V_{2\&3}}{R3}$$
$$I_{R3} = \frac{2V}{10k\Omega}$$
$$I_{R3} = I_{R4} = 0.200mA$$



Lab 08 – Series Parallel Circuits

Learning Objectives

- Build series / parallel circuits as per a schematic diagram
- Measure electrical values using a digital voltmeter
- Use Ohm's Law to reduce a series /parallel circuit to the simplest form
- Use a data table and schematic diagrams to capture field measurements

		Points Possible
Documentation	Quality of documentation (neatness, clarity, spelling, grammar), Expected and measured values recorded on schematic diagram	**10**
General	Expected and measured resistor values recorded in data table with percent error	**5**
Circuit 1	Expected and measured resistance, current and voltage recorded in data table with percent error	**10**
Circuit 2	Expected and measured resistance, current and voltage recorded in data table with percent error	**10**
Circuit 3	Voltages measured, currents calculated for both R2 values.	**5**
Conclusions	Questions answered completely & accurately	**10**
	Total	**50**