

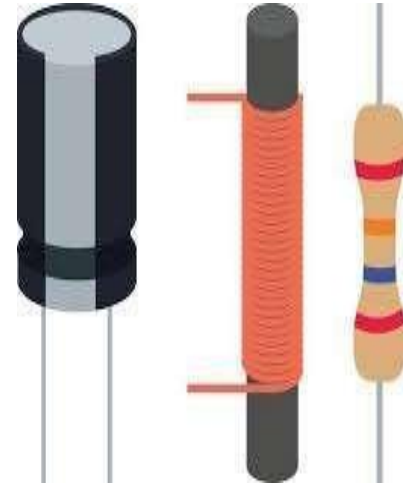
Department of Artificial Intelligence and Data Science

23EET103-Electric Circuits and
Electron Devices

I B.Tech. AIDS / II SEMESTER

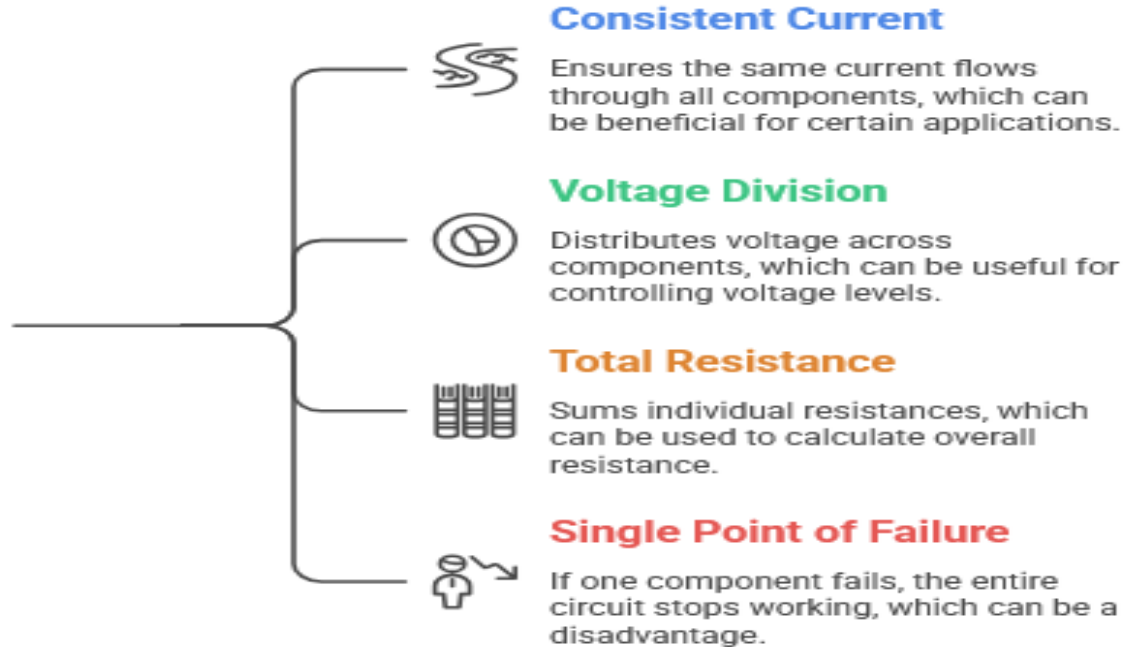
UNIT I : DC CIRCUITS

Topic 5 : Parallel Circuits



Recall!!!

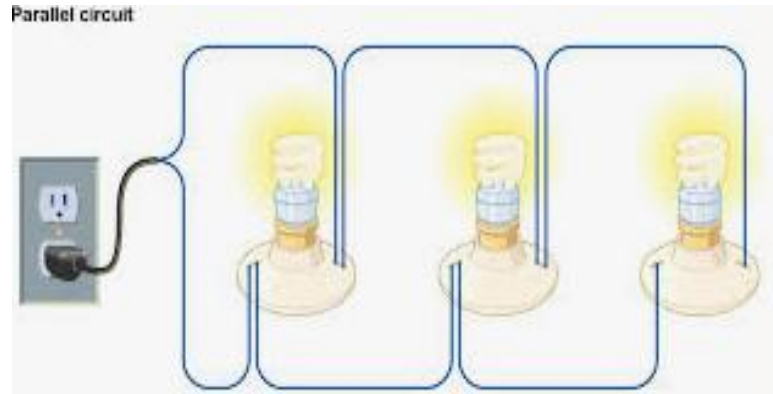
Is a series circuit suitable for the application?



What is a Parallel Circuit?

A **parallel circuit** is a circuit where components are connected across the **same two points**, giving **multiple paths** for current.

 **More than one path** for electricity to flow.



Key Rule #1: Voltage

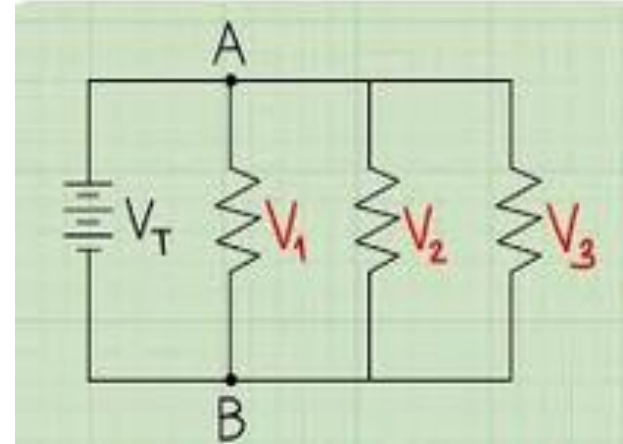
In a parallel circuit:

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$$V_{\text{total}} = V_1 = V_2 = V_3$$

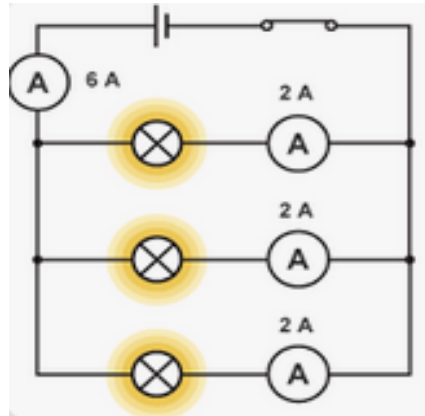
👉 Voltage is same across all branches.

Each component gets the full supply voltage.



Key Rule #2: Current

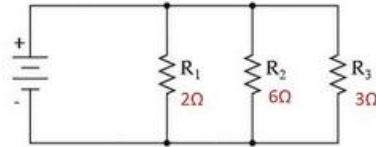
- $I_{\text{total}} = I_1 + I_2 + I_3$



- Current **splits** among branches depending on resistance.
- Lower resistance branch → more current.

Key Rule #3: Resistance

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$



Calculate the total resistance of the circuit.

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_t} = \frac{6}{12} + \frac{2}{12} + \frac{4}{12}$$

👉 Total resistance in parallel is **less than the smallest resistor**.

- More branches = **less total resistance**.

Problem 1 (Find Total Resistance)

Given:

$$R_1 = 6\Omega, R_2 = 3\Omega$$

$$\frac{1}{R_T} = \frac{1}{6} + \frac{1}{3}$$
$$\frac{1}{R_T} = \frac{1+2}{6} = \frac{3}{6}$$
$$R_T = 2\Omega$$

✓ Answer: 2Ω

Problem 2 (Find total Current)

Given:

$$V = 12V$$

$$R_1 = 6\Omega, R_2 = 3\Omega$$

First find $R_T = 2\Omega$

$$I_T = \frac{V}{R_T} = \frac{12}{2} = 6A$$

Problem 3 (Current Across Each Resistor)

$$I_1 = \frac{V}{R_1} = \frac{12}{6} = 2A$$

$$I_2 = \frac{V}{R_2} = \frac{12}{3} = 4A$$

Check:

$$I_T = 2 + 4 = 6A \checkmark$$

Problem 4 (Three Resistors)

Given:

$$R_1 = 4\Omega, R_2 = 4\Omega, R_3 = 4\Omega$$

$$\frac{1}{R_T} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$$

$$R_T = \frac{4}{3} = 1.33\Omega$$

Continue Problem 4

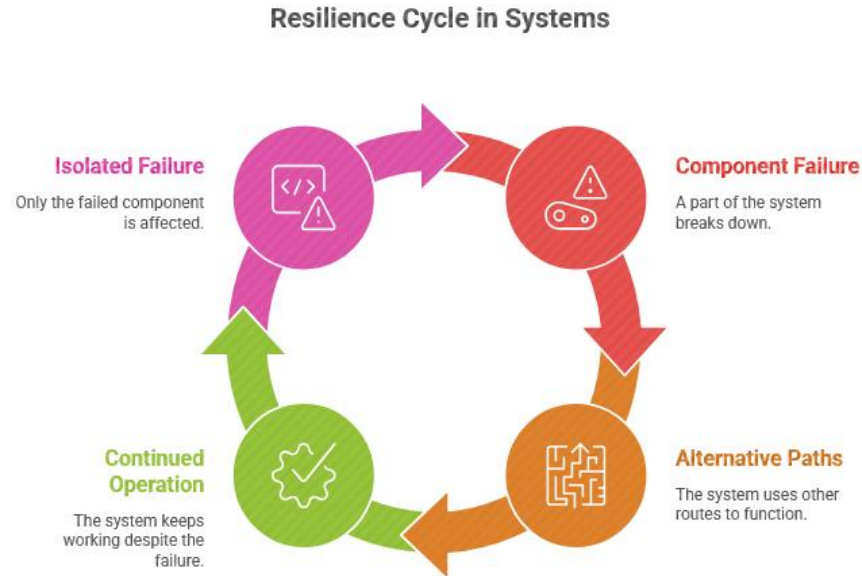
If supply voltage = 12V

$$I_T = \frac{12}{1.33} \approx 9A$$

Each branch current:

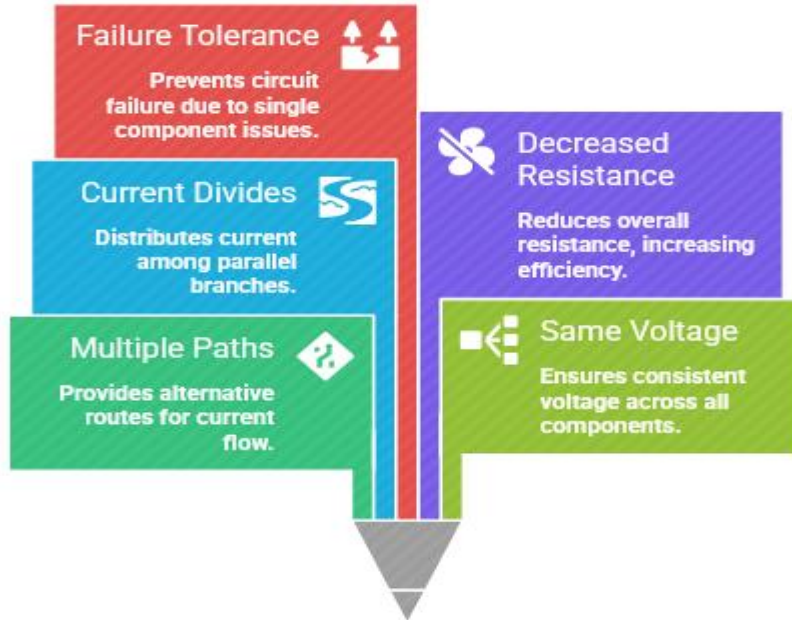
$$I = \frac{12}{4} = 3A$$

What Happens if One Branch Fails?



Let's Summarize

Parallel Circuit Advantages



Golden Formula Set

$$V_T = V_1 = V_2$$

$$I_T = I_1 + I_2 + I_3$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

Conceptual / Thinking

Parallel Circuits Explained

What is a parallel circuit?

Each bulb is connected in a separate branch across the same voltage source.

What happens when one bulb fuses?

Only that branch becomes open. The other branches remain complete circuits, so current can still flow through them.

Why do the other bulbs continue to glow?

They still receive the full supply voltage.

What is the key idea?

Parallel circuit = multiple paths. One path fails → others still work.



How to ensure continuous lighting in a circuit?



Parallel Circuit

Ensures continuous lighting



Series Circuit

Fails completely when one bulb fuses

REFERENCES

- <https://www.britannica.com/technology/parallel-circuit>
- <https://www.electronicshub.org/parallel-circuit>
- <https://www.geeksforgeeks.org/physics/parallel-circuit-formula>
- <https://www.allaboutcircuits.com/textbook/direct-current/chpt-3/parallel-circuits>



*Thank
you!*