Date:

Assignment no 2

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Subject:- Basic Electronics

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Part A

(1)
DEFINE

- **Series circuit:-**

A series circuit is a type of electrical circuit in which components are connected end-to-end in a single path. In this type of arrangment the same current flows through each component because there is only one path for current to flow.

- **parallel circuit:-**

A parallel circuit on the other hand, is a circuit in which components are connected across same two points, forming multiple paths for current to flow. Each component has the same voltage across it but current can vary across different components.

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• Behaviour :-

1) Series circuits :-

• The total voltage (V_{total}) across the circuit is the sum of voltages across each component

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

• The current is the same through all components in the circuit.

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

• The total resistance is sum of all individual resistances.

$$R_{total} = R_1 + R_2 + R_3 + \text{----}$$

2) Parallel circuits :-

• The voltage across each branch is same as the voltage of circuit.

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

• The total current is the sum of current through each branch

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

• The total resistance (R_{total}) is less than smallest branch resistance.

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \text{----}$$

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CHARACTERISTICS

• Total Resistance :-

The total Resistance in a series circuit is calculated by adding the resistances of all components in the circuit.

$$R_{total} = R_1 + R_2 + R_3 + \cdots + R_n$$

• Distribution :-

1) Current :-

The current (I) is same throug all resistors in a series circuit becaus there is only one path for current to flow

$$I_{total} = I_1 = I_2 = I_3 = \cdots$$

2) Voltage :-

The total voltage (V_{total}) of the power supply is divided across all resistors, with each resist receiving a portion of total voltage based on resistance

$$V_{total} = V_1 + V_2 + V_3 + \cdots$$

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PARALLEL CIRCUIT

• Total Resistance:-

The total resistance (R_{total}) in a parallel circuit is determined by the reciprocal of the sum of the reciprocals of individual resistances.

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_n}$$

• Distribution:-

1) Current:-

In a parallel circuit, the total current (I_{total}) from power supply is divided among various branches of circuit. The amount of current flowing through each branch depends upon resistance of individual components.

$$I_{total} = I_1 + I_2 + I_3 + \cdots$$

2) Voltage:-

In a parallel circuit, all components recieve the same voltage from power source. This is because each component is directly connected across same two points so the voltage across each component is equal to total voltage.

$$V_{total} = V_1 = V_2 = V_3 = \cdots = V_n$$

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COMPARISON TABLE

SERIES CIRCUIT	PARALLEL CIRCUIT
• Total resistance increases as more resistors are added.	• Total Resistance decreases as more resistors are added
• Voltage is divided among resistors based on their resistances.	• Voltage is same across all resistors.
• The current is same through all components	• Current is divided among branches, depending on their resistance
• Used in applications where same current must flow through all components such as in Christmas lights, fuses or battery powered circuits	• Used in applications where components need same voltage such as in household electrical wiring, parallel circuits ~~and~~ in devices.

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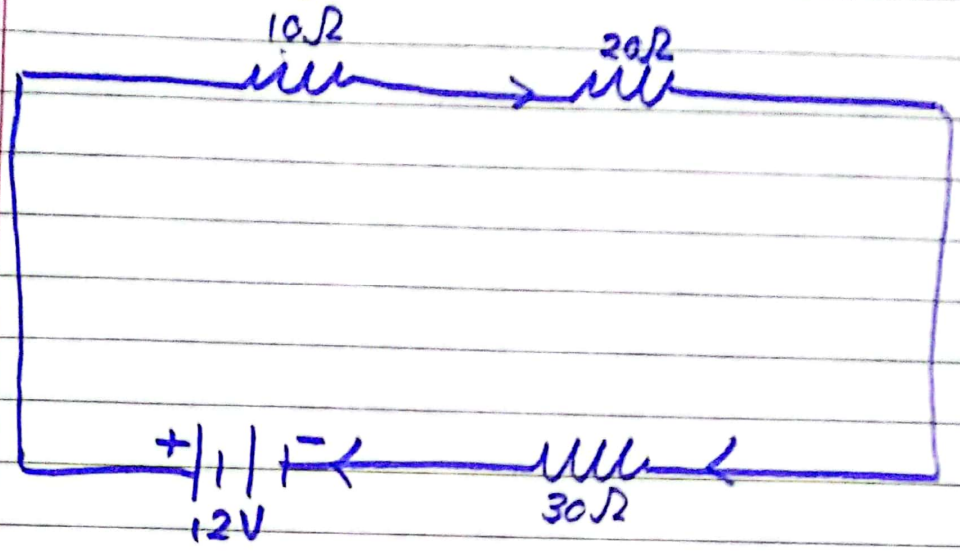
Part B

Problem 1



- **Total Resistance:-**

Sol:-

$R_1 = 10\Omega$, $R_2 = 20\Omega$, $R_3 = 30\Omega$

$R_{total} = R_1 + R_2 + R_3$

$= 10 + 20 + 30$

$R_{total} = 60\Omega$

- **Total current:-**

$V = 12V$, $R_{total} = 60\Omega$

$I = \frac{V}{R_{total}} = \frac{12}{60} = 0.2A$

$I = 0.2A$

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• Voltage drop:-

1) Voltage drop across R_1:-

$$V_1 = IR_1$$
$$V_1 = 0.2 \times 10$$
$$V_1 = 2V$$

2) Voltage drop across R_2:-

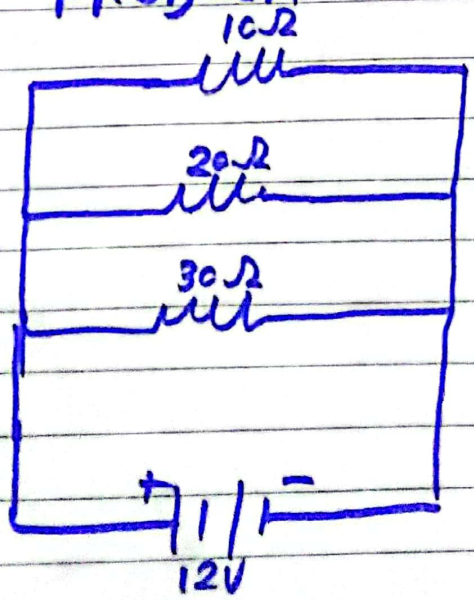
$$V_2 = IR_2$$
$$V_2 = 0.2 \times 20$$
$$V_2 = 4V$$

3) Voltage drop across R_3:-

$$V_3 = IR_3$$
$$V_3 = 0.2 \times 30$$
$$V_3 = 6V$$

(2)

PROBLEM 2



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• Total Resistance :-

Sol:-

$R_1 = 10\Omega$, $R_2 = 20\Omega$, $R_3 = 30\Omega$

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{10} + \frac{1}{20} + \frac{1}{30}$$

$$\frac{1}{R_{total}} = \frac{6}{60} + \frac{3}{60} + \frac{2}{60}$$

$$\frac{1}{R_{total}} = \frac{11}{60}$$

$$R_{total} = \frac{60}{11} = 5.45\Omega$$

• Total current :-

Sol:-

$V = 12V$, $R_{total} = 5.45\Omega$

$$I_{total} = \frac{V}{R_{total}}$$

$$= \frac{12}{5.45}$$

$$I_{total} = 2.2A$$

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- Current through resistor:-

1) R_1

$$I_1 = \frac{V}{R_1} = \frac{12}{10} = 1.2A$$

2) R_2

$$I_2 = \frac{V}{R_2} = \frac{12}{20} = 0.6A$$

3) R_3

$$I_3 = \frac{V}{R_3} = \frac{12}{30} = 0.4A$$

Part C

(1) REAL-LIFE APPLICATIONS

- Uses of parallel circuits in wiring:-
- Parallel wiring allows appliances to function properly
- Each appliance in a parallel circuit receives same voltage as the main supply
- A fault or burnout in one appliance does

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not disrupts functioning of others

- **Use of series circuits in wiring:-**

- Series circuits are rarely used in home wiring. one example is wiring of safety devices, such as smoke detectors or security systems, where all devices need to operate as a group.

Importance of using parallel connections

Safety and Reliability:-
if one appliance fails, rest continue to work, avoiding complete system outages

Energy efficency:-
Each device can be operated as its rated voltage, which ensures ~~pow~~ efficent power usage

Flexibility:-
Homeowners can add or remove devices without disrupting the entire electrical system.

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SAFETY CONSIDERATION

1) Series circuit:-

- When a fuse blows in a series circuit. the entire circuit is interrupted because the current has only one path to flow. All devices connected in series stop working.

2) Parallel circuit:-

In a parallel circuit a blown fuse affects only the branch where fault occurs. other branches continue to function because each branch operates independently with its own current path.

Safety Precautions:-

- Fuses and circuit Breakers:-

Fuses and circuit makers protect circuits from overloading and short circuits by breaking circuit when excessive current flows.

- Grounding:-

Grounding wires direct excess safety into earth, reducing risk of electric shocks and fire

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- proper insulation :-
All wiring is insulated to prevent short circuits and accidental contact with live wires

- Correct circuit design :-
circuits are designed with appropriate wire gauges, and parallel connections to handle expected loads safely.

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