SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore-35

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECB101-CIRCUIT ANALYSIS AND DEVICES

I YEAR/ II SEMESTER

UNIT 2 – NETWORK THEOREMS AND SOURCE TRANSFORMATION

TOPIC –   NETWORK THEOREMS-SUPERPOSITION THEOREM

Network Theorems

- Network theorems are fundamental principles in electrical engineering and circuit analysis that help simplify and analyze complex electrical networks.

- These theorems provide mathematical tools and techniques to determine various circuit parameters, such as current, voltage, power, and resistance.

- The fundamental theory on which many branches of electrical engineering, such as electric power, electric machines, control, electronics, computers, communications, and instrumentation, are built is the Electric circuit theory.

What is Superposition Theorem?

The superposition theorem is a circuit analysis theorem used to solve the network

where two or more sources are present and connected.

Superposition theorem states the following:

"In any linear and bilateral network or circuit having multiple independent sources, the

response of an element will be equal to the algebraic sum of the responses of that

element by considering one source at a time."

Network Theorems

- To calculate the individual contribution of each source in a circuit, the other source must be replaced or removed without affecting the final result.

- This is done by replacing the voltage source with a short circuit. While removing a voltage source, its value is set to zero.

- When removing a current source, its value is set to infinite. This is done by replacing the current source with an open circuit.

- The superposition theorem is very important in circuit analysis because it converts a complex circuit into a Norton or Thevenin equivalent circuit.

How to Apply Superposition Theorem?

- The first step is to select one among the multiple sources present in the bilateral network. Among the various sources in the circuit, any one of the sources can be considered first.

- Except for the selected source, all the sources must be replaced by their internal impedance.

- Using a network simplification approach, evaluate the current flowing through or the voltage drop across a particular element in the network.
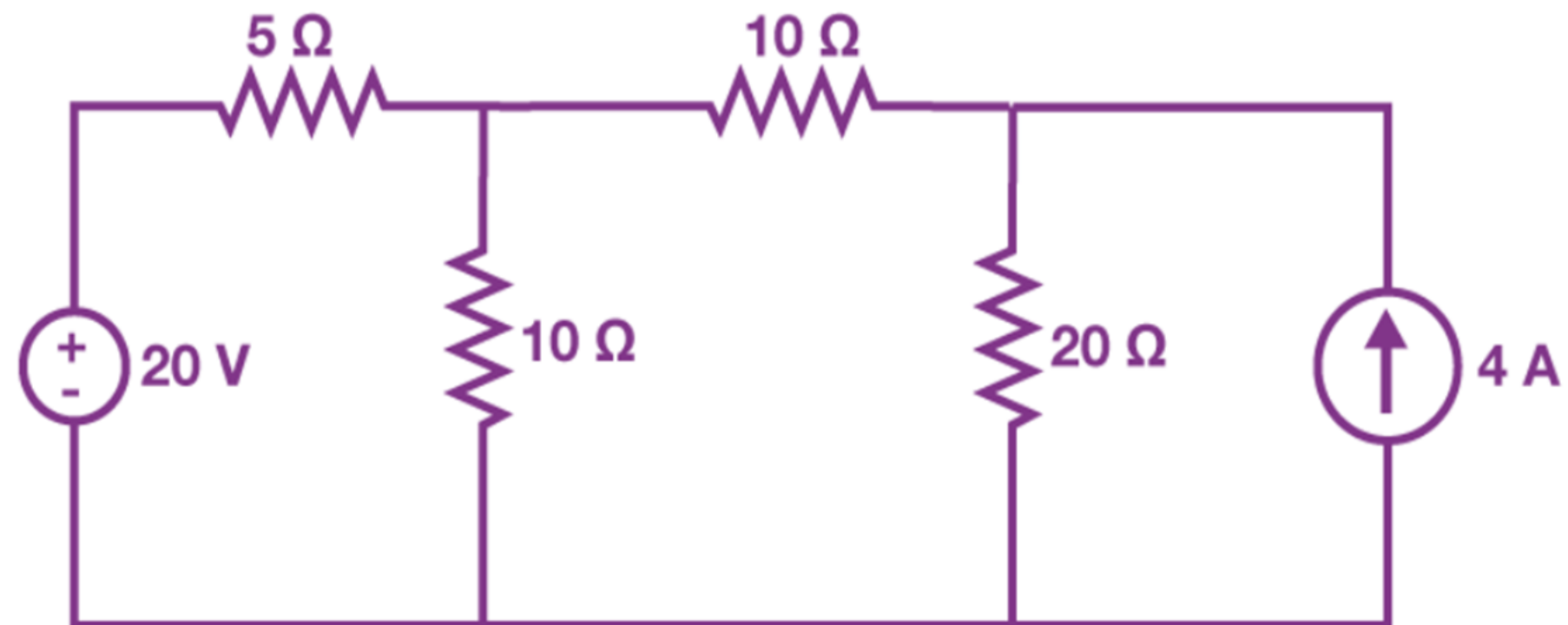
Network Theorems

- The same considering a single source is repeated for all the other sources in the circuit.

- Upon obtaining the respective response for individual source, perform the summation of all responses to get the overall voltage drop or current through the circuit element.

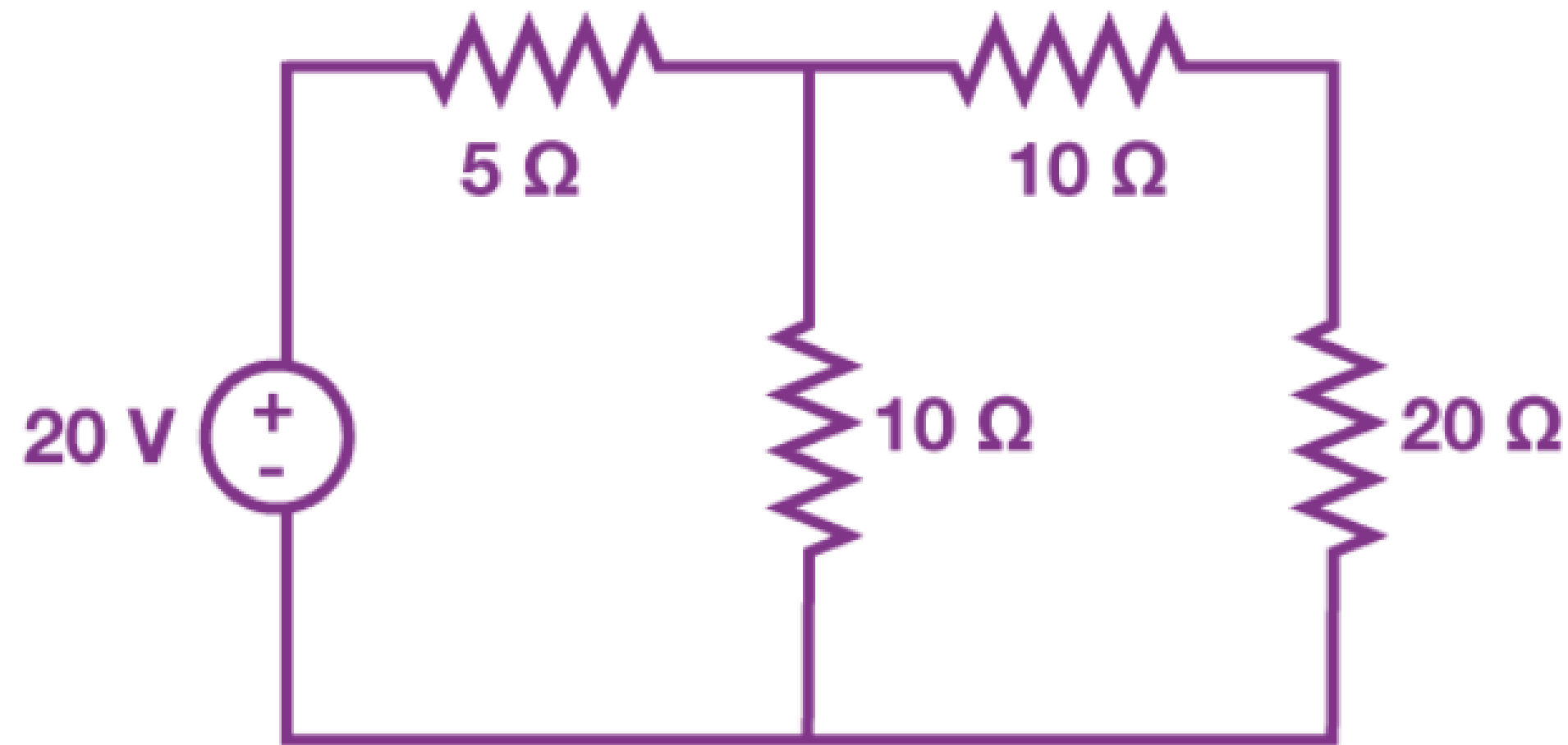**Example 1:** Find the current flowing through 20 Ω using the superposition theorem.

Solution:

Step 1: First, let us find the current flowing through a circuit by considering only the 20 V voltage source. The current source can be open-circuited, hence, the modified circuit diagram is shown in the following figure.
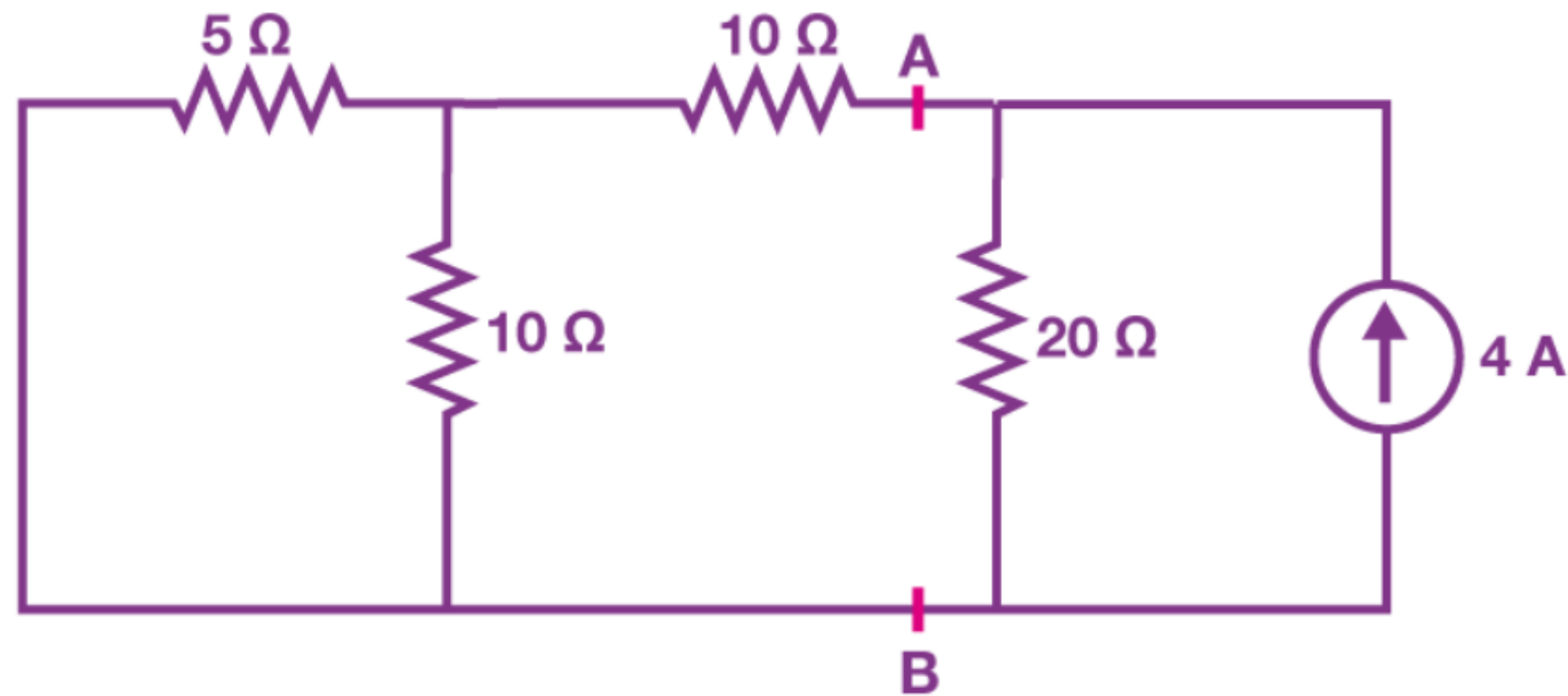
Step 3: Now let us find out the current flowing through the 20 Ω resistor considering only the 4 A current source. We eliminate the 20 V voltage source by short-circuiting it. The modified circuit, therefore, is given as follows:

THANK YOU