

# Superposition Theorem Statement

The statement of the superposition theorem is very simple and straightforward. 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. The superposition theorem is important for the [GATE exam](#). Since we have two basic electrical quantities like, voltage & current, an element's response would obviously be either voltage or current.

## Superposition Theorem is Applicable to

The superposition theorem is based on the concept of linearity between the output and input. It has two properties, namely, homogeneity and additivity. Hence, the superposition theorem can be applied only to circuits having linear and bilateral elements. By using the superposition theorem, we can easily calculate the response of an element when individually one source is present in the circuit.

## Procedures of Superposition Theorem

We can easily solve the network theory problems by using the Superposition theorem whenever the electric circuit/network contains multiple sources. Now, let's see the steps for finding the response of an element when multiple independent sources are present in the network/circuit by using the superposition theorem.

- **Step 1:** Draw the equivalent circuit by considering only one independent source & by replacing the other independent sources with their internal resistances.
- **Step 2:** Find the circuit's response (voltage or current) of an element, which we got in Step 1.
- **Step 3:** Repeat Steps 1 & 2 for every independent source present in the given circuit.
- **Step 4:** Do the algebraic sum of all the responses got in step 2.

## Limitations of Superposition Theorem

We have seen how easily one can find the response of an element when the electric circuit consists of multiple independent sources by using the superposition theorem. It is equally important that one should know where we can't apply the superposition theorem also. The limitations of this theorem are mentioned below.

- The superposition theorem can't be applied to non-linear and/or unilateral networks/circuits.
- We can't apply a superposition theorem if only one source is present in the given circuit.
- We can't apply the superposition theorem directly to find the power since it is a non-linear quantity.

In this article, we discussed the statement of the superposition theorem and how to apply this theorem to DC circuits. Similarly, we can apply the superposition theorem to find the response of an element when the circuit consists of multiple AC sources or a combination of DC and AC sources.

## Superposition Theorem Problems

The superposition theorem and problems related to it are used in the [GATE question paper](#) for formulating the MCQ-based questions to test the comprehensive knowledge of the candidates. Let us see a few examples of the superposition theorem problems.

**Question 1:** Find the current,  $I$  of the following electric circuit by using the superposition theorem.

**Answer:**  $1/3$  A

**Question 2:** Find the voltage,  $V$ , of the following electric circuit by using the superposition theorem.

**Answer:**  $20/3$  volts

