# Basic Electrical Technology

## Class 8 – 17 November 2021

- Network Theorems 1

# Terminologies Used

- **Linear element:** V-I characteristics is linear. E.g: R, L, C
- **Non-linear element:** V-I characteristics is non-linear. E.g: Diode
- **Bi-lateral element:** Property does not change with direction of operation. E.g: R, L, C
- **Unilateral element:** Property changes with the direction of operation. E.g: Diode
- **Linear Circuit:** Circuit with linear elements only
- **Bi-lateral circuit:** Circuit with bi-lateral elements only.
- **Response:** The output of the network. E.g: current, voltage

# Superposition Theorem

- **Definition** : In **any linear, bi-lateral** network, **total response** is the **sum** of partial responses.

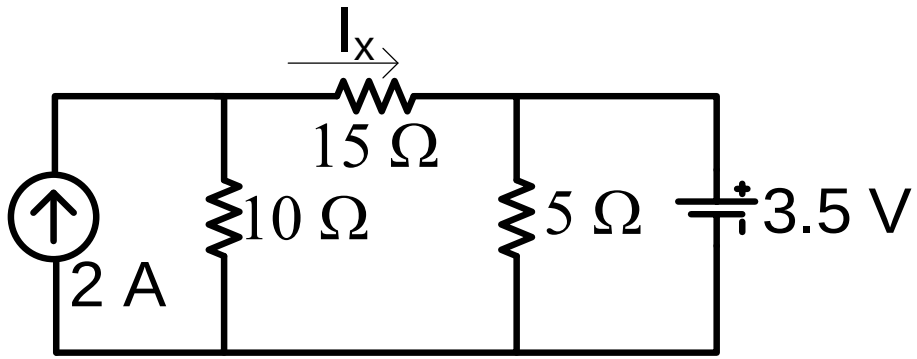
- In any linear, bilateral network, the total response may be determined by adding the responses due to individual sources, considering one source at a time and replacing the other sources by their internal resistances.

# Procedure to apply Superposition theorem to solve a DC Circuit

1. Draw the circuit with passive elements only.
2. Place one of the sources in its position.
3. Replace the other sources by their internal resistances.
   a. Ideal **voltage** source by short circuit,
   b. Ideal **current** source by open circuit.
4. Find the response using one of the methods, i.e., network reduction, mesh current, node voltage methods.
5. Repeat the procedure for all the sources.
6. Add the responses due to individual sources.

# Illustration 1

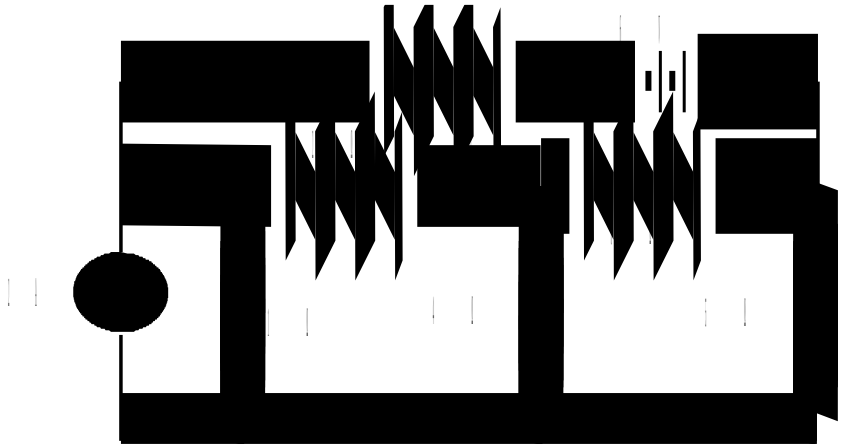
Find the current $I_x$ using Superposition theorem




**Ans: $I_x$ = 660 mA**

# Illustration 2

Find the current $I_0$ using Superposition theorem



**Ans: $I_0$ = -105.078mA**

# Limitations of superposition Theorem

- **Doesn't work for power calculation**
  - Involves product of voltage and current,
  - the square of current or
  - the square of the voltage,
  - which are **non-linear** operations
  - **cannot be applied for nonlinear circuit**