

**Paper 1, TDC Part-1**  
**Chapter– 4, Circuit Theorems**  
**Lecture – 3 Superposition Theorem**

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## **Circuit Theorem – Superposition Theorem**

- Today we will discuss problem on circuits with dependent source. It can be either dependent current or dependent voltage source.
- Now let us see fourth example with dependent source.
- In circuit with dependent source, we will never short circuit the dependent voltage source.
- Similarly we will never open circuit the dependent current source.

# Circuit Theorem – Superposition Theorem

- Fourth example with dependent source.

Q Determine  $I_x$ ,  $I_y$  and  $V_z$  using the Superposition method.

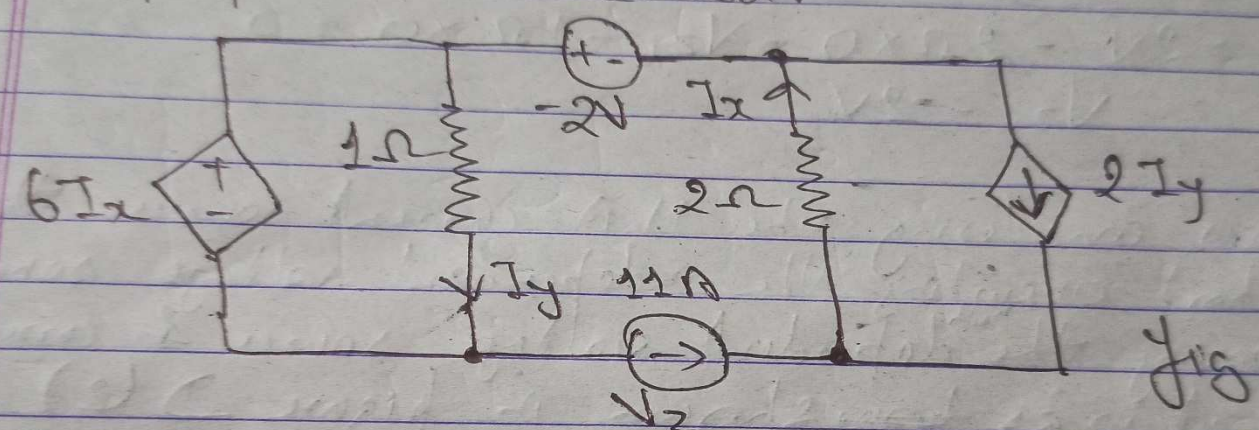


fig D

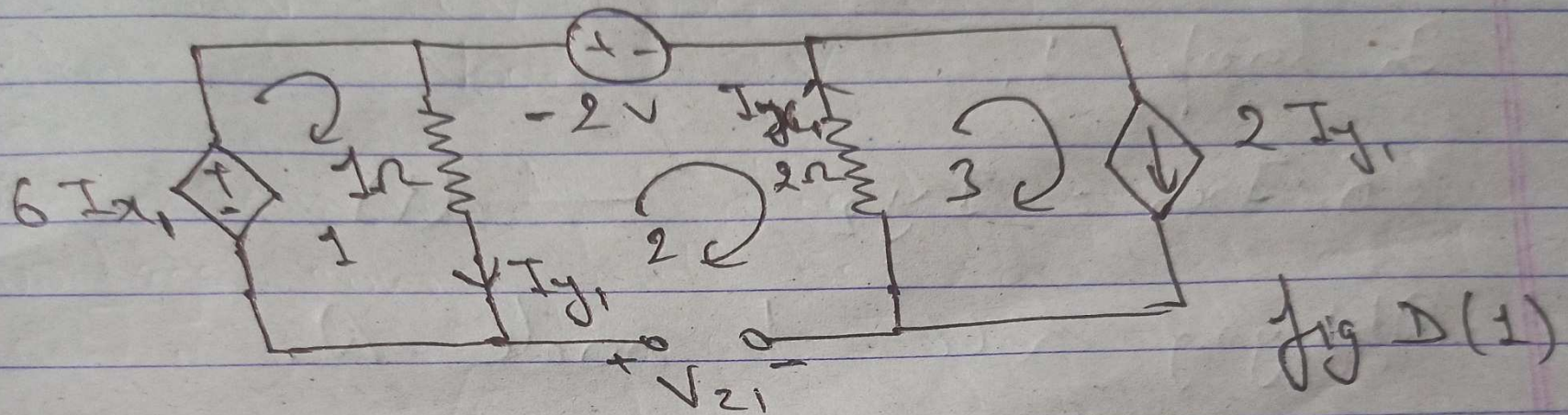
Soln:- Taking voltage source of  $-2V$  first, then the independent current source will be open circuit.

The dependent voltage source and dependent current source will not be off. so the ckt was shown in fig D(1).



# Circuit Theorem – Superposition Theorem

shown in fig D(1).



In loop 1,

$$-6I_{x_1} + 1\Omega \times I_{y_1} = 0$$

$$I_{y_1} = 6I_{x_1}$$

In loop 3,

$$2I_{y_1} = I_{x_1}$$

Therefore  $I_{x_1} = I_{y_1} = 0$

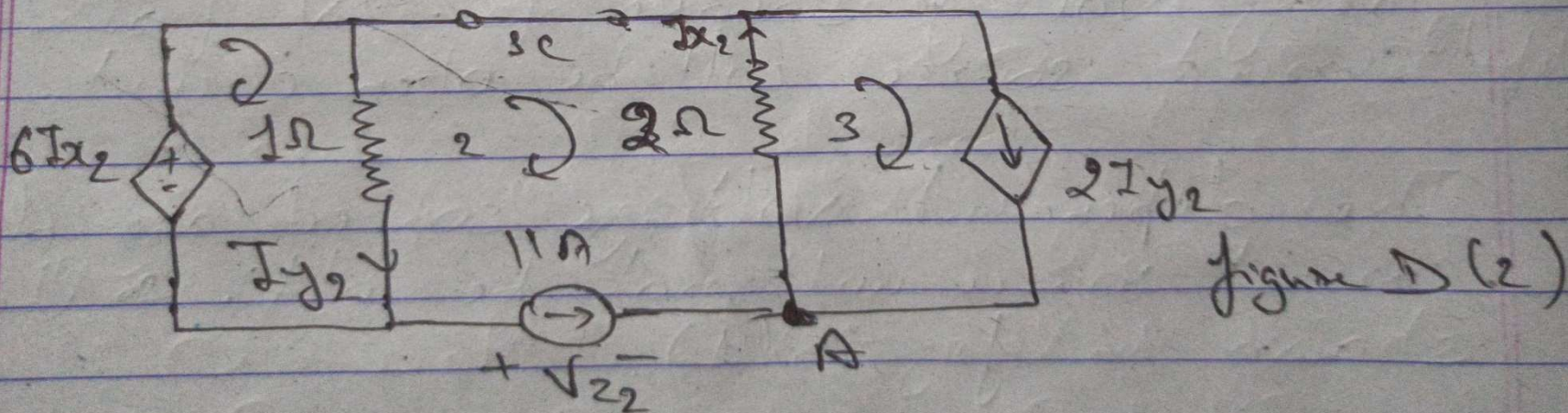


# Circuit Theorem – Superposition Theorem

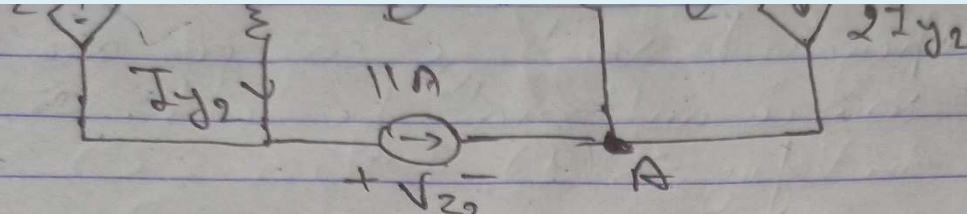
Applying KVL in loop 2.

$$-2V - 2\Omega \times 0 - V_{21} - 1\Omega \times 0 = 0$$
$$V_{21} = -2V$$

Now considering the 11 A current source then short circuiting the independent voltage source, while leaving the dependent voltage source & current source as it is, as shown in figure D(2)



# Circuit Theorem – Superposition Theorem



The diagram shows a circuit with a central node labeled 'A'. A 11A current source is connected to node A from the left. A branch with a dependent current source  $2I_{y2}$  is connected to node A from the right. Another branch with a dependent current source  $I_{y2}$  is connected to node A from the left. A voltage source  $V_{z2}$  is also connected to node A. The diagram is labeled 'figure D(2)'.

In loop 1,

$$6 I_{x2} = I_{y2} \quad \text{--- (i)}$$

Applying KCL at node A.

$$11A + 2 I_{y2} - I_{x2} = 0$$
$$11A + 2 \times 6 I_{x2} - I_{x2} = 0 \quad \text{putting value of } I_{y2} = 6 I_{x2} \text{ from (i)}$$
$$I_{x2} = -1A.$$
$$I_{y2} = -6A.$$



# Circuit Theorem – Superposition Theorem

Apply KVL,

$$1\Omega \times I_{y2} + 2\Omega \times I_{x2} - V_{z2} = 0$$

~~$1\Omega \times 1A +$~~

$$(1 \times 6)V + (2 \times 1)V - V_{z2} = 0$$

$$V_{z2} = 8V$$

$$\text{So } I_{x1} = I_{x1} + I_{x2} = 0 + (-1) = -1A$$

$$I_{y1} = I_{y1} + I_{y2} = 0 + (-6) = -6A$$

$$V_z = V_{z1} + V_{z2} = (-2 + 8)V = 6V$$

# **Circuit Theorem – Superposition Theorem**

For any query contact at “9771474020”.

*Thank You*