Superposition Theorem

1. In superposition theorem, when we consider the effect of one voltage source, all the other voltage sources are _____
   a) Shorted
   b) Opened
   c) Removed
   d) Undisturbed

Ans a

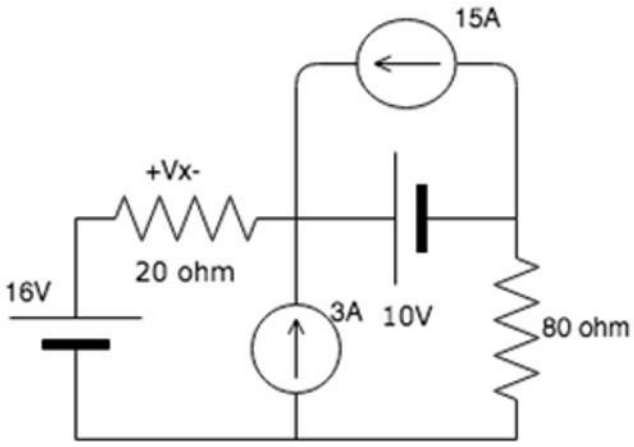
2. In superposition theorem, when we consider the effect of one current source, all the other voltage sources are _____
   a) Shorted
   b) Opened
   c) Removed
   d) Undisturbed

Ans a

3. In superposition theorem, when we consider the effect of one voltage source, all the other current sources are _____
   a) Shorted
   b) Opened
   c) Removed
   d) Undisturbed

Ans b

4. Find the value of Vx due to the 16V source.



a) 46.8V
b) 3.2V
c) 2.3V
d) 6.3V

Ans a:

When we consider the 16V source, we short the 10V source and open the 15A and 3A source. From the resulting series circuit we can use voltage divider to find Vx.

*Vx = 16*20/(20+80)=3.2V.*

Due to the 3A source, we short the 16V and 10V source and open the 15A source. From the resulting circuit, we can use current divider to find the current in the 20 ohm branch and then multiply it with the resistance to find the voltage.

*I20 = 3*80/(20+80)=2.4A (←)*

*Vx=-20*2.4=-48V.*

Due to the effect of the 10V source, we short the 16V source and open the 3A and 15A source. From the resulting series circuit, we can use voltage divider to find the value of Vx.

*Vx=-10*20/(80+20)=-2V.*

Due to 15 A current source, 10V and 16V sources get shorted and the 3A source acts as an open circuit. Since the 10V source is shorted, it acts as a low resistance path and current flows only within that loop and do not flow to the 20 ohm resistor. Hence the voltage is 0V.

Vx= Sum of Vx each case

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5. Superposition theorem is valid for _____
   a) Linear systems
   b) Non-linear systems
   c) Both linear and non-linear systems
   d) Neither linear nor non-linear systems

Ans:a

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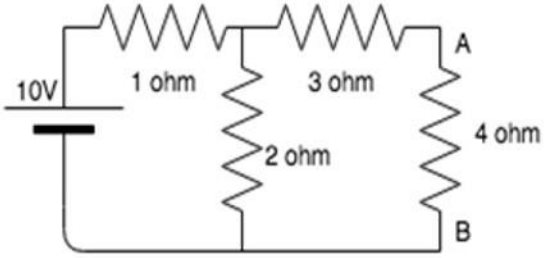
6. Superposition theorem does not work for _____
   a) Current
   b) Voltage
   c) Power
   d) none of the above

Ans C

Thevenin's Theorem

1. Find the Thevenin resistance across the terminal AB



a) 4.34 ohm
b) 3.67 ohm
c) 3.43 ohm
d) 2.32 ohm

Answer: b

Explanation: Thevenin resistance is found by opening the circuit between the specified terminal and shorting all voltage sources. When the 10V source is shorted, we get: Rth=(1||2)+3=3.67 ohm.

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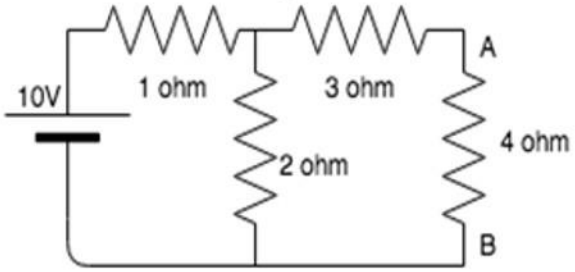
2. Calculate V_{th} for the given circuit.



a) 5.54V
b) 3.33V
c) 6.67V
d) 3.67V

Ans C

*4 ohm is removed and then v across 2 ohm is calculated by voltage divider 2*10/(2+1) = 6.67V. Voltage between A and B i.e. V_{th} is equal to voltage across 4 ohm resistance since no current flow through 3 ohm resistance. So, V_{th} = 6.67V.*

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3. The Thevenin voltage is the_____
   a) Open circuit voltage
   b) Short circuit voltage
   c) Open circuit and short circuit voltage
   d) Neither open circuit nor short circuit voltage

Answer: a

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4. Thevenin resistance is found by _____
   a) Shorting all voltage sources
   b) Opening all current sources

c) Shorting all voltage sources and opening all current sources
d) Opening all voltage sources and shorting all current sources

Answer: c

5. The Thevenin voltage is the_____
   a) Open circuit voltage
   b) Short circuit voltage
   c) Open circuit and short circuit voltage
   d) Neither open circuit nor short circuit voltage

Answer: a

6. Which of the following is also known as the dual of Thevenin's theorem?
   a) Norton's theorem
   b) Superposition theorem
   c) Maximum power transfer theorem
   d) Millman's theorem

Answer a

7. Can we use Thevenin's theorem on a circuit containing a BJT?
   a) Yes
   b) No
   c) Depends on the type BJT
   d) Depend on source

Answer b

Norton's Theorem

1. The Norton current is the_____
   a) Short circuit current
   b) Open circuit current
   c) Open circuit and short circuit current
   d) Neither open circuit nor short circuit current

Answer a

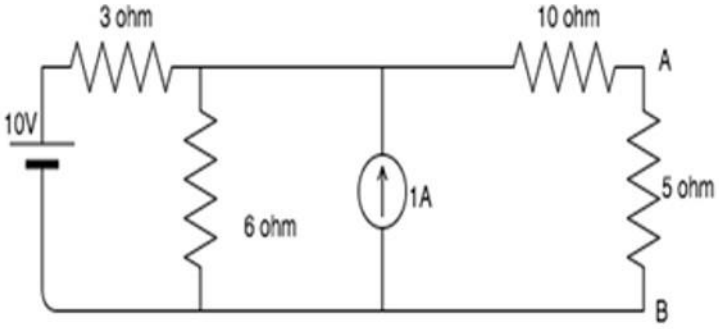
2. Norton resistance is found by?
   a) Shorting all voltage sources
   b) Opening all current sources
   c) Shorting all voltage sources and opening all current sources
   d) Opening all voltage sources and shorting all current sources

Answer C

3. Norton's theorem is true for _____
   a) Linear networks
   b) Non-Linear networks
   c) Both linear networks and nonlinear networks
   d) Neither linear networks nor non-linear networks

Answer a

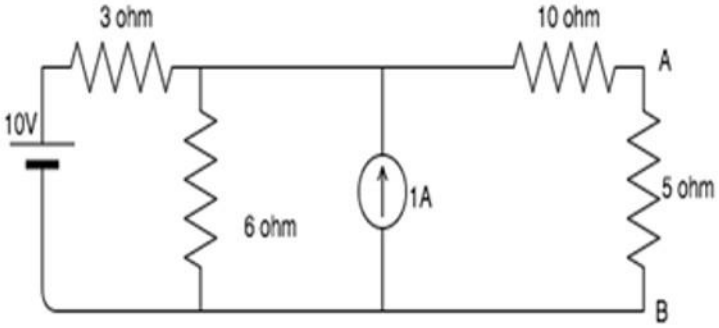
4. Calculate the Norton resistance for the following circuit if 5 ohm is the load resistance.



   a) 10 ohm
   b) 11 ohm
   c) 12 ohm
   d) 13 ohm

Answer C :RN=(3||6)+10 = 12 ohm.

5. Find the current in the 5 ohm resistance using Norton's theorem.



a) 1A
b) 1.5A
c) 0.25A
d) 0.5A

Answer d: Shorting all voltage sources and opening all current sources we have:
R_N=(3||6)+10 = 12 ohm.
Since the 5 ohm is the load resistance, we short it and find the resistance through the short.
If we apply source transformation between the 6 ohm resistor and the 1A source, we get a 6V source in series with a 6 ohm resistor. Now we have two meshes. Let us consider I1 flowing in the first mesh and I2 flowing in the second mesh.
The mesh equations are:
9I1-6I2=4
-6I1+16I2=6
On solving these equations simultaneously, we get I2=0.72A, which is the short circuit current.
Connecting the current source in parallel to R_N which is in turn connected in parallel to the load resistance=5ohm, we get Norton's equivalent circuit.
*Using current divider: I = 0.72*12/(12+5) = 0.5 A.*

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6. If Vth= 3v and Rth= 7 ohm, then the value of Norton's Current and resistance are
   a) 7/3A, 21ohm
   b) 21A, 7/3 ohm
   c) 21 A, 7 ohm
   d) 3/7 A, 7 ohm

Answer d

Maximum Power Transfer Theorem

1. The maximum power is delivered from a source to its load when the load resistance is _____ the source resistance.
   a) greater than
   b) less than
   c) equal to
   d) less than or equal to

Answer C

2. The maximum power drawn from source depends on _____
   a) Value of source resistance
   b) Value of load resistance
   c) Both source and load resistance
   d) Neither source or load resistance

Answer b

3. Does maximum power transfer imply maximum efficiency?
   a) Yes
   b) No
   c) Sometimes
   d) Cannot be determined

Answer: b Explanation: Maximum power transfer does not imply maximum efficiency. If the load resistance is smaller than source resistance, the power dissipated at the load is reduced while most of the power is dissipated at the source then the efficiency becomes lower.

4. Under the condition of maximum power efficiency is?
   a) 100%
   b) 0%
   c) 30%
   d) 50%

Answer d

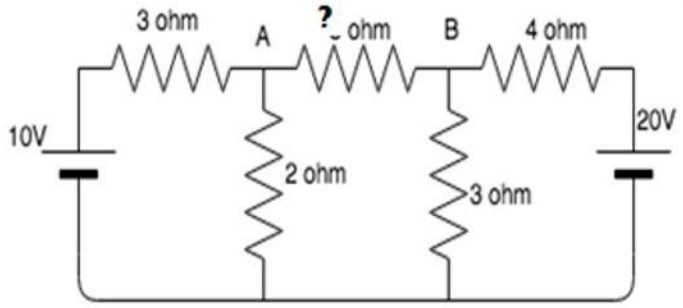
5. Name some devices where maximum power has to be transferred to the load rather than maximum efficiency.
   a) Amplifiers
   b) Communication circuits
   c) Both amplifiers and communication circuits
   d) Neither amplifiers nor communication circuits

Answer: c

Explanation: Maximum power transfer to the load is preferred over maximum

efficiency in both amplifiers and communication circuits since in both these cases the output voltage is more than the input.

6. What Should be the resistance across AB so that maximum power is delivered?



a)3 ohm

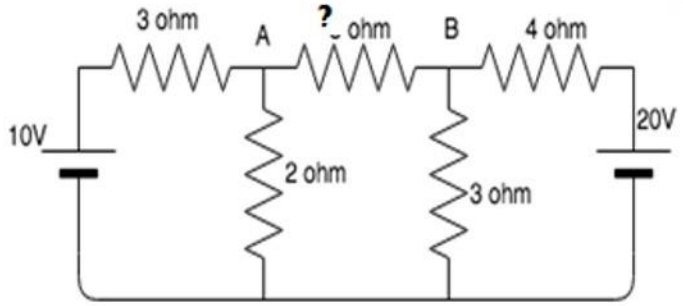
b)2.91 ohm

C) 2 ohm

d) 3.91 ohm

Answer: b
Explanation: On shorting the voltage sources:
RL=3||2+4||3 = 1.20+1.71 = 2.91 ohm.

7. What Should be the maximum power dissipated across AB?



a) 1.79W
b) 4.55W
c) 5.67W
d) 3.78W

Answer: a
Explanation: On shorting the voltage sources:
RL=3||2+4||3 =1.20+1.71=2.91 ohm.
Calculating E_{th}=4.57V
The maximum power transferred = $Eth^2/4RL$. Substituting the given values in the formula, we get Pmax = 1.79W.

8. .....theorem is particularly useful for analysing communication networks.

A. Milliman's Theorem

B. Thevenin's Theorem

C. Superposition Theorem

D. Maximum Power Transfer Theorem