GOVERNMENT POLYTECHNIC COLLEGE BHILWARA

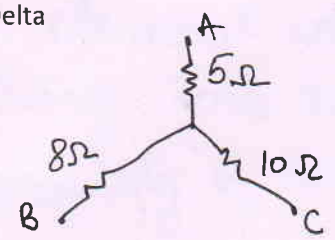
EL-302

I MID TERM: 27TH November 2017

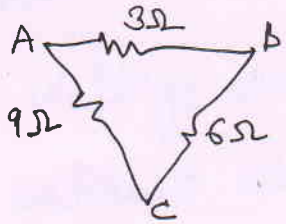
II- Year Electronics **Maximum Marks: 15**

All Questions are compulsory/ सभी प्रश्न अनिवार्य हैं

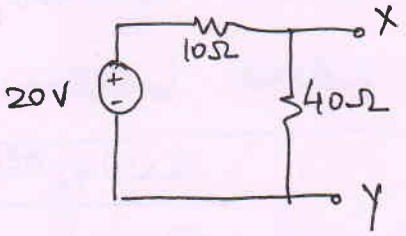
1. Explain the difference between **any 1** of the following: [2 marks]
   a. Active and Passive Voltage and Current sources
   b. Independent and Dependent sources
2. Explain Kirchhoff's Voltage Law and Kirchhoff's Current Law with example [3 marks]
3. Convert the given circuits from one form to another: [3 marks]
   a. Start to Delta



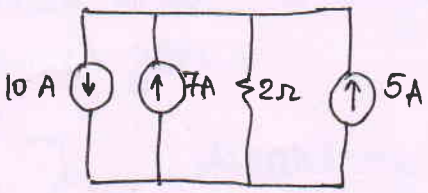
   b. Delta to Star



4. Calculate Thevenin's Voltage and Resistance in the given circuit to the left of XY [4 marks]

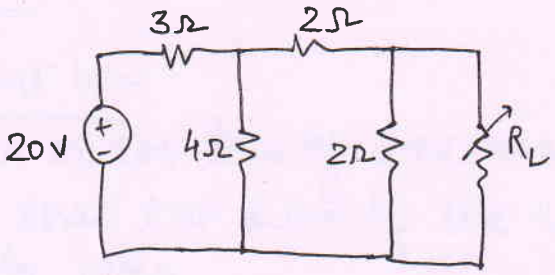


5. Find the voltage drop in the 2 ohm resistor [4 marks]



OR

Find the value of the load resistance R_L for maximum power transfer to the load R_L



SOLUTIONS

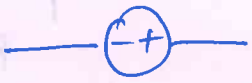
1(a) Active and passive elements

→ An element which is capable of delivering energy for a long time is called an active element

OR

an element which is having the property of internal amplification is called active element. (eg. voltage source)

→ Similarly an element which is not capable for delivering energy for a long time or the element which is not having the property of internal amplification is called passive element.

(b) Independent voltage source 

Independent current source 

Dependent voltage source 

Dependent current source 

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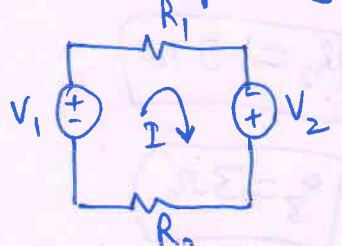
2) Kirchoff's Voltage law:

→ This law is based on the law of conservation of energy

→ This law states that the algebraic sum of voltages across a closed loop is zero.

eg:



According to KVL:

$+V_1 - IR_1 + V_2 - IR_2 = 0 \Rightarrow \boxed{V_1 + V_2 = I(R_1 + R_2)}$

Kirchoff's Current Law:

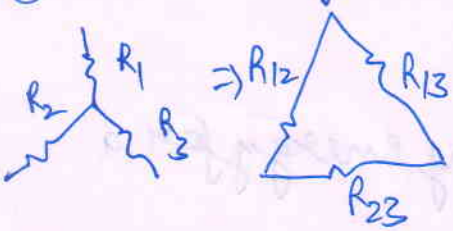
→ This law is based on the law of conservation of charge

→ This law states that the sum of the currents meeting at a node is equal to zero

eg:

$\boxed{i_1 + i_2 - i_3 + i_4 = 0}$

(3) (a) using the conversion formulae from Y to Δ

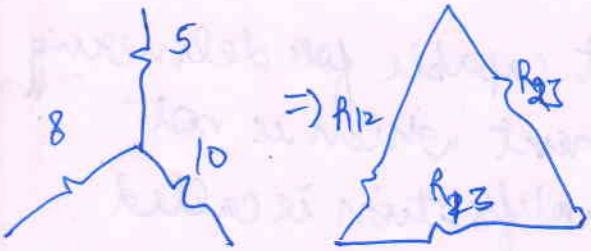


$$R_{12} = R_1 + R_2 + \frac{R_1 R_2}{R_3}$$

$$R_{23} = R_2 + R_3 + \frac{R_2 R_3}{R_1}$$

$$R_{13} = R_1 + R_2 + \frac{R_1 R_3}{R_1}$$

For the given configurations

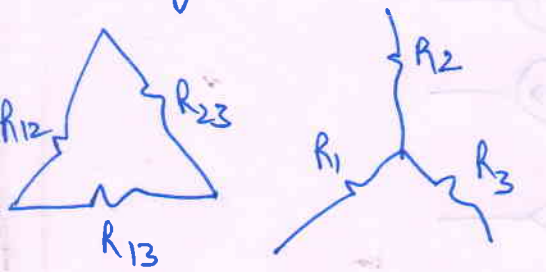


$$R_{12} = 8 + 5 + \frac{8 \times 5}{10} \Rightarrow \boxed{R_{12} = 17\,\Omega}$$

$$R_{23} = 5 + 10 + \frac{5 \times 10}{8} \quad \boxed{R_{23} = 21.25\,\Omega}$$

$$R_{13} = 8 + 10 + \frac{8 \times 10}{5} \quad \boxed{R_{13} = 34\,\Omega}$$

(b) using the conversion formulae from Δ → Y

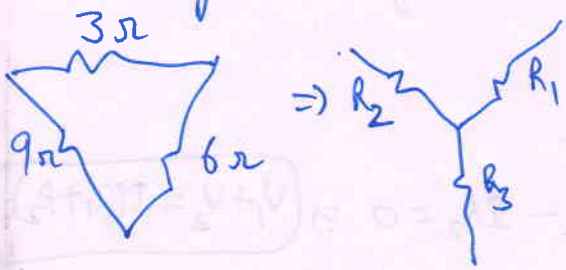


$$R_1 = \frac{R_2 R_{23}}{R_{12} + R_{23} + R_{13}}$$

$$R_2 = \frac{R_{12} R_{23}}{R_{12} + R_{23} + R_{13}}$$

$$R_3 = \frac{R_{13} R_{23}}{R_{12} + R_{23} + R_{13}}$$

For the given configuration

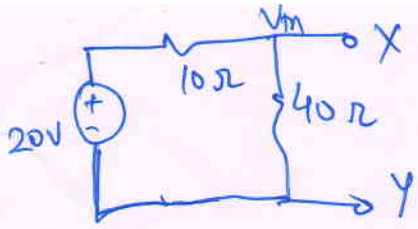


$$\Rightarrow R_1 = \frac{6 \times 3}{18} \Rightarrow \boxed{R_1 = 1\,\Omega}$$

$$R_2 = \frac{9 \times 3}{18} \Rightarrow \boxed{R_2 = 1.5\,\Omega}$$

$$R_3 = \frac{6 \times 9}{18} \Rightarrow \boxed{R_3 = 3\,\Omega}$$

4)



For the given circuit:

Let V_{TH} = Thevenin voltage

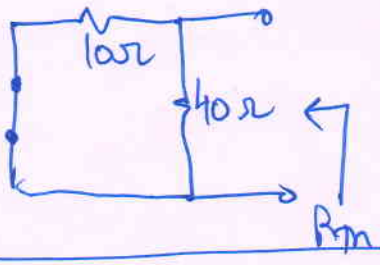
Using KCL

$$\frac{V_{TH}-20}{10} + \frac{V_{TH}}{40} = 0$$

$$\frac{4V_{TH} + V_{TH}}{40} = 2 \Rightarrow 5V_{TH} = 80$$

$$\boxed{V_{TH} = 16\ V}$$

For the calculation of R_{TH}



$$\frac{1}{R_{TH}} = \frac{1}{10} + \frac{1}{40} \Rightarrow \boxed{R_{TH} = 8\Omega}$$

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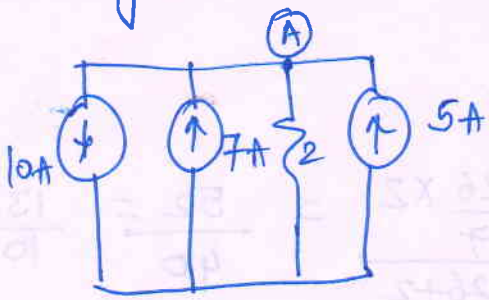
5) For the given circuit



let the voltage at node A be V_A

Applying KCL at node 'A':

$$+10 - 7 + \frac{V_A}{2} - 5 = 0$$

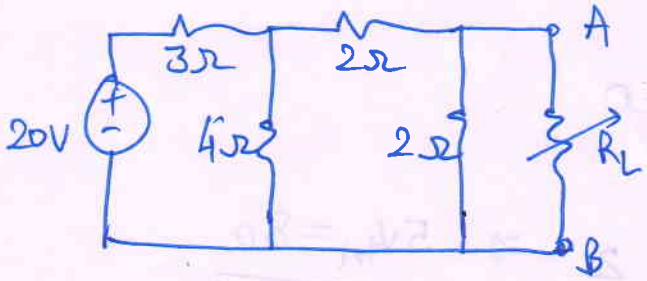
$$\frac{V_A}{2} - 2 = 0$$

$$\boxed{V_A = 4\ V}$$

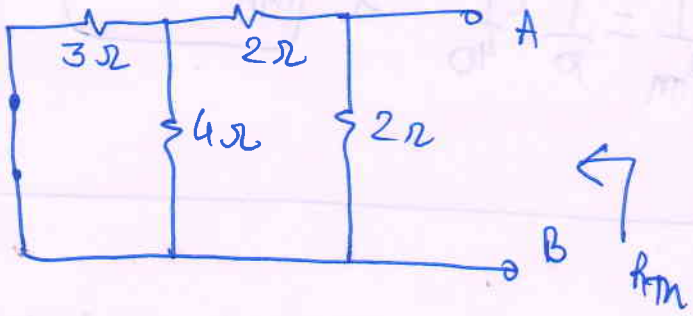
Therefore voltage across 2Ω resister is **4 volts**

(OR)

(5) Given circuit



To calculate the value of R_L for maximum power transfer: We disconnect the load resistance R_L and calculate the internal resistance of the circuit from terminals AB



$$R_{TH} = \left(\frac{3\times4}{3+4} + 2\right) \| 2\Omega$$

$$= \left[\left(\frac{12}{7}+2\right) \| 2\right]\Omega = \frac{\frac{26}{7}\times 2}{\frac{26}{7}+2} = \frac{52}{40} = \frac{13}{10}$$

$$R_{TH} = 1.3\Omega$$

(P. D. Upadhyay)