GOVERNMENT POLYTECHNIC COLLEGE BHILWARA

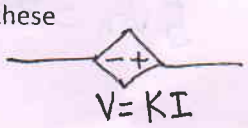
I MID TERM: 29TH November 2017

II- Year Electrical-EE:205 **Maximum Marks: 15**

All Questions are compulsory/ सभी प्रश्न अनिवार्य हैं

MULTIPLE CHOICE QUESTIONS

1. Which of the following quantity cannot be measured using Superposition Theorem: [1/2 marks]
   [a] Current [b] Voltage [c] Power [d] None of these
2. Kirchoff's Current Law can be applied on which parts of a circuit: [1/2 marks]
   [a] Loop [b] Node [c] Branch [d] All of these
3. The given figure represents which type of circuit element: [1 marks]



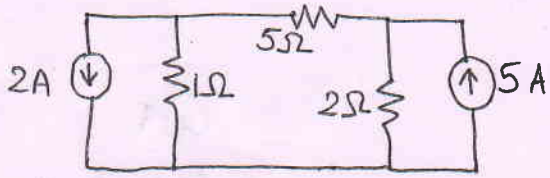
   [a] Voltage Dependent Voltage Source
   [b] Current Dependent Voltage Source
   [c] Current Dependent Current Source
   [d] Voltage dependent current source

SHORT ANSWER QUESTIONS

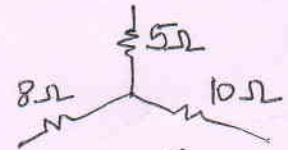
4. Define Kirchoff's Voltage Law [1/2 marks]
5. Define Tellegen's Theorem [1/2 marks]
6. Draw diagrams of Independent and Dependent Sources [1 marks]
7. How do you understand by Thevenin Voltage and Thevenin Resistance of a circuit [1 marks]

LONG ANSWER QUESTIONS

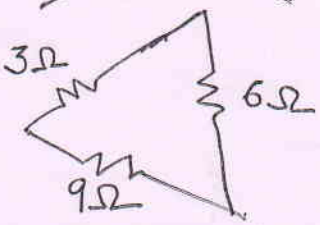
8. Find the current in the 5 ohm resistor using KCL [3 marks]



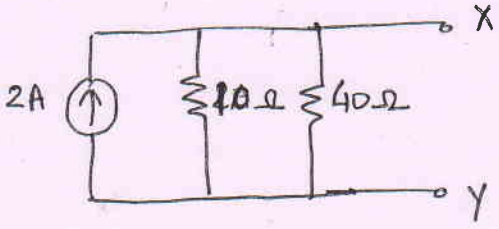
9. Convert the given circuit from one form to another [3 marks]
   a. Star to Delta



   b. Delta to Star



10. Calculate the Thevenins's Equivalent circuit to the left of XY in the given circuit [4 marks]



SOLUTIONS

1st Mid Term (EE-205) (29/11/2017)

(1) (c) Power

Superposition Theorem is applicable for linear quantities. Since power is a non-linear function of V and I, hence it cannot be used for power calculation

(2) (b) Node

In a circuit currents (incoming and outgoing) can be added at a node only, hence KCL is applicable only at a node

(3) (b) Current dependent voltage source

Since the voltage is a linear function of current, hence the given source is a current dependent voltage source.

(4) Kirchoff's voltage Law is based on the law of conservation of energy. This law states that the algebraic sum of voltages in a closed loop is zero.

(5) Tellegen's Theorem states that the sum of the powers developed in a closed circuit is zero. This theorem is applicable for linear as well as non linear circuits, Time Variant as well as Time Invariant circuits.

(6) Independent voltage source — $v = 10$ volts

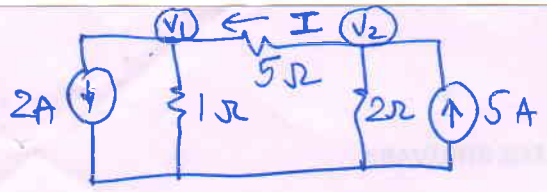
Independent current source — $i = 5$ Amperes

Dependent voltage source — $V = KV_1$ or $V = Ki_1$

Dependent current source — $i = KV_1$ or $i = Ki_1$

(7) Thevenin Voltage is the open-circuit voltage across the terminals of a network (whose Thevenin equivalent is to be calculated) Thevenin Resistance is the resistance of a network when all the voltage and current sources are replaced by their internal resistances.

8)



Let V_1 and V_2 be the unknown node voltages.

using KCL at Node 1: $\frac{V_1}{(1\Omega)} + \frac{V_1 - V_2}{(5\Omega)} + 2 = 0 \Rightarrow 6V_1 - V_2 = -10$ — (1)

using KCL at Node 2: $\frac{V_2}{(2\Omega)} + \frac{V_2 - V_1}{(5\Omega)} - 5 = 0 \Rightarrow -2V_1 + 7V_2 = 50$ — (2)

Solving eq's (1) & (2), we have $V_1 = -0.5$ volts, $V_2 = 7$ volts

Hence current: $I = \frac{V_2 - V_1}{5} = \frac{7.5}{5} \Rightarrow I = 1.5$ Amperes

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9) (a)

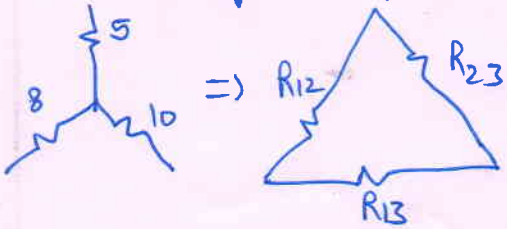
using the conversion formulae from Y → Δ

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

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

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

For the given figure



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

$R_{23} = 5 + 10 + \frac{5 \times 10}{8} \Rightarrow R_{23} = 21.25\Omega$

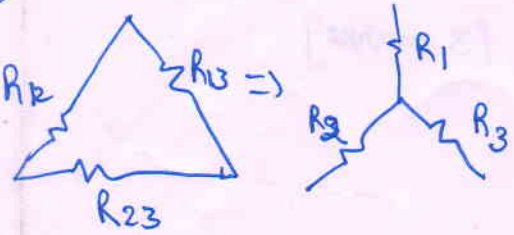
$R_{13} = 8 + 10 + \frac{8 \times 10}{5} \Rightarrow R_{13} = 34\Omega$

(b)

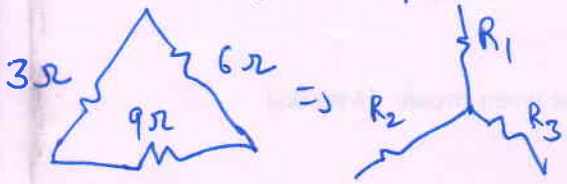
using the conversion formulae for Δ → Y

$$R_1 = \frac{R_{12} R_{13}}{R_{12} + R_{23} + R_{13}} \qquad R_3 = \frac{R_{13} R_{23}}{R_{12} + R_{23} + R_{13}}$$

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



For the given figure

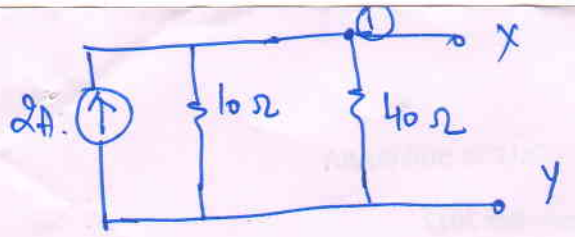


$R_1 = \frac{6 \times 3}{18} \Rightarrow R_1 = 1\Omega$

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

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

(10)



(i) Thevenin voltage

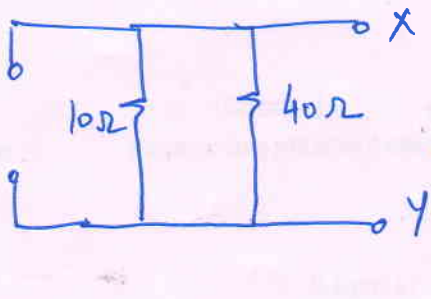
using KCL at Node (1) $\quad \frac{V_m}{40} + \frac{V_m}{10} - 2 = 0$

$$\frac{V_m + 4V_m}{40} = 2$$

$$5V_m = 80 \Rightarrow \boxed{V_m = 16 \text{ volts}}$$

(ii) Thevenin Resistance

equivalent circuit can be drawn as:



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

(P.D. Upadhyay)