Linear Circuit Theory

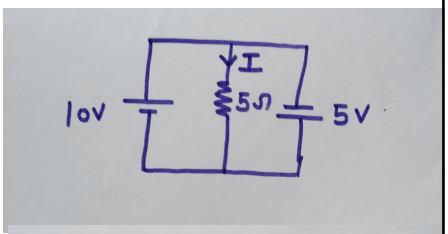
L02: Nodal Analysis

- Solution of Question of last lecture
- Nodal Analysis with concepts of super node
- Concepts of dependent source
- Tutorial seat problems

Last lecture question:

1. Which one have more resistance 1KW Heater or 2KW and why

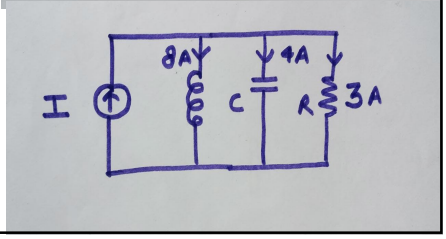
Power is given by $P = \frac{V^2}{R}, or\ I^2R$ but all appliance are made for parallel connection therefore Voltage is same and $P \propto \frac{1}{R}$. 1KW has more resistance then 2KW



2. Calculate the current in both the figure as shown

(a) 10 V and 5V are connect in parallel, circuit connection is not possible

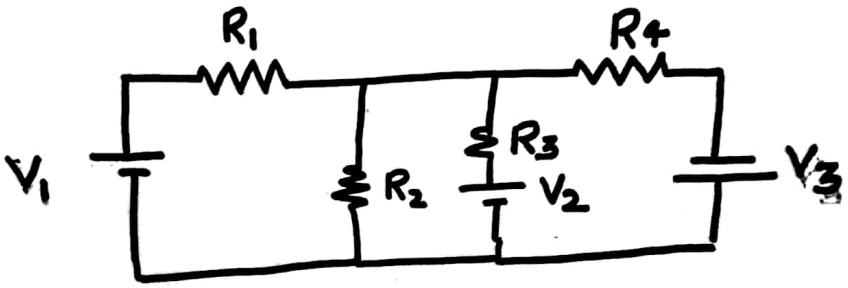
(b) Current $I = \sqrt{I_R^2 + (I_L^2 - I_C^2)}$ Ans=5A



Nodal Analysis (based on KCL)

Where nodal analysis required ?

*Number of node is minimum



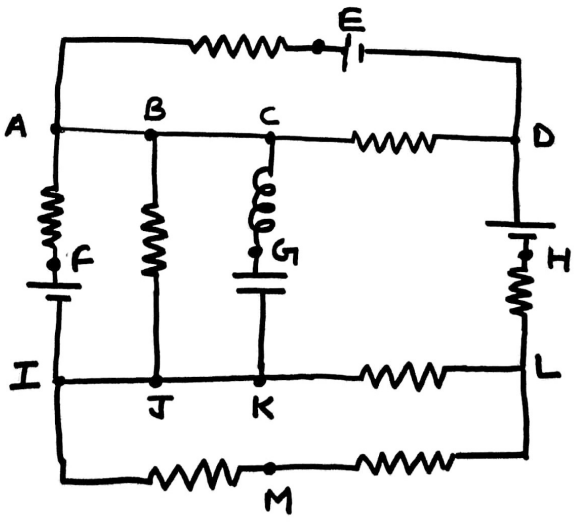
Ultimate aim to solve a problem with minimum effort

Nodal Analysis

Three basic rule to apply

1.Selection of node

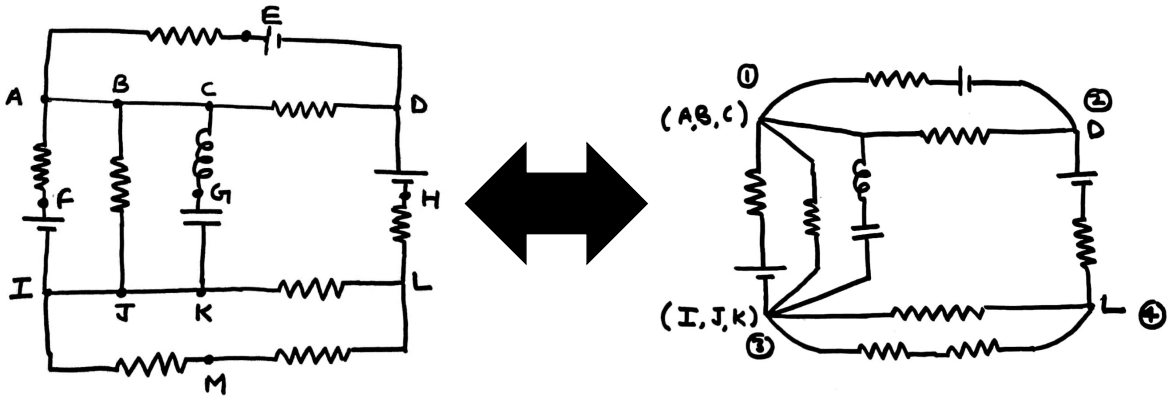
- Current same between the device remove the node(F, G, H, M, E)
- If between two node, no elements or source consider single node (A, B, C) and (I,J, K)



(Ultimate purpose is to reduced the number of variable)

2. Assumption of node voltage

- Always consider one node as ground



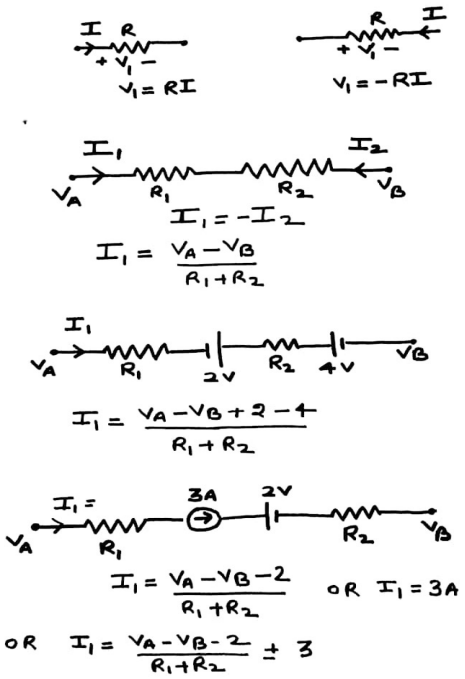
- Different Possible case of branch Current flow

a. Voltage current relation

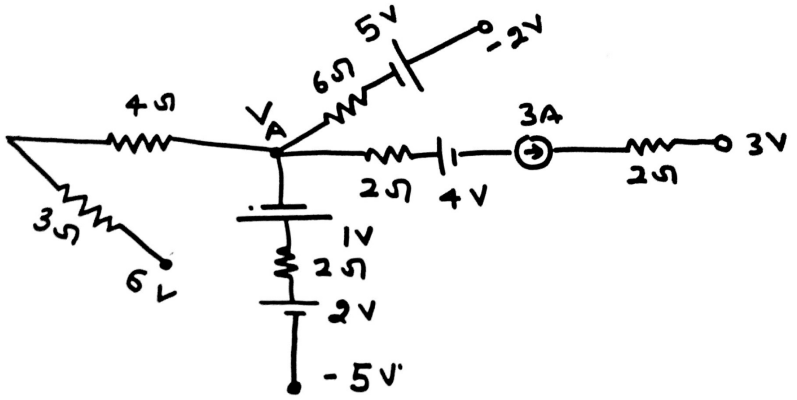
b. Current only with resistance

c. Current with voltage consideration

d. With current source

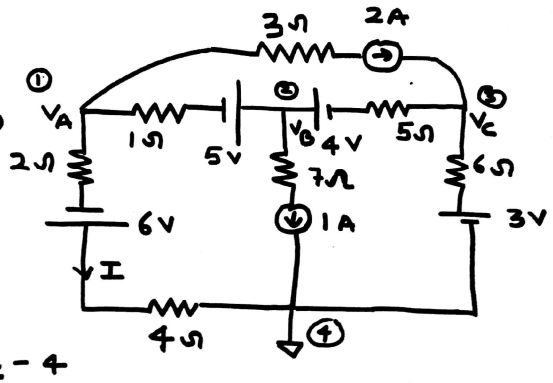


3. Apply KCL



$$\frac{V_A-6}{4+3}+\frac{V_A+5+1-2}{2}+\frac{V_A+2+5}{6}+3=0$$

Numerical Example



① NODE-1

$$\frac{V_A+6}{2+4}+\frac{V_A-V_B+5}{1}+2=0$$

② NODE-2

$$\frac{V_B-V_A-5}{1}+1+\frac{V_B-V_C-4}{5}=0$$

③ NODE-3 $\quad \frac{V_C-V_B+4}{5}-2+\frac{V_C-3}{6}=0$

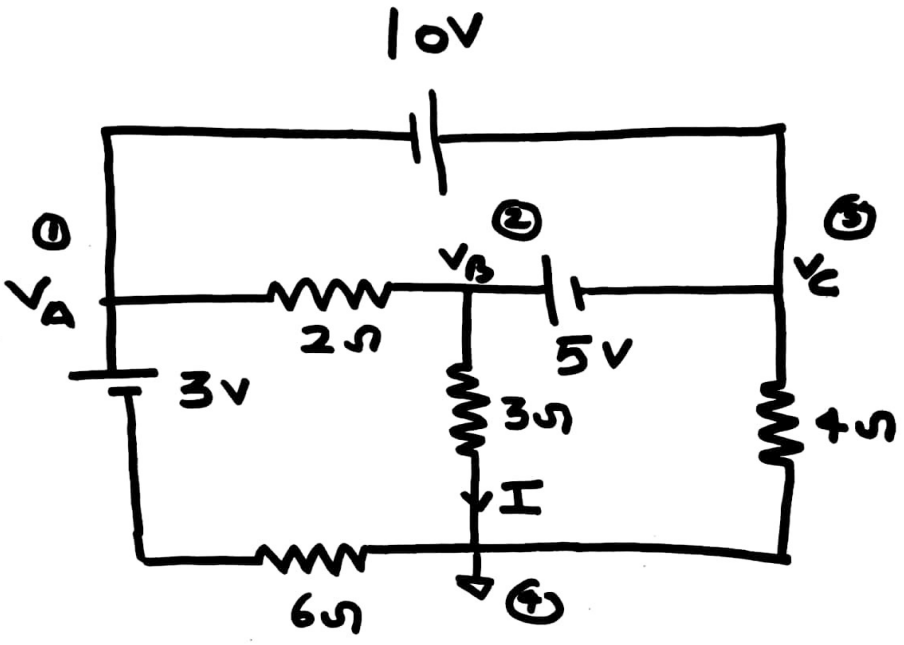
Super Node Analysis

@ KCL at

Node-1 ???

Node-2 ???

Node-3 ???



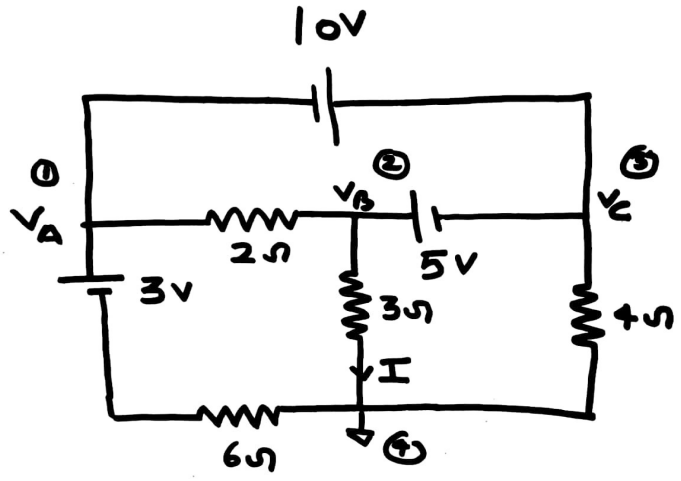
Method to solve the super node mesh problem

$V_A - V_C = -10$

$V_B - V_C = 5$

AT NODE-4

$$\frac{0 - V_A + 3}{6} + \frac{0 - V_B}{3} + \frac{0 - V_C}{4} = 0$$



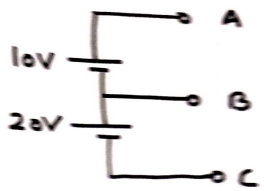
Tutorial basic question Seat

(a) Calculate value of VA , VB, VC, VAB , VBC , VCA

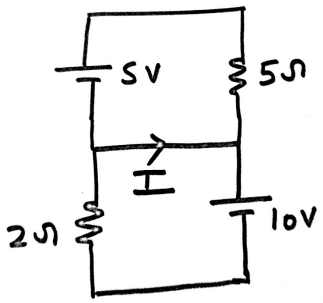
(b) Calculate I

(C) Calculate V_0

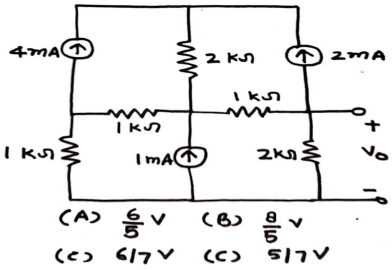
(b) Calculate Voltage across current source



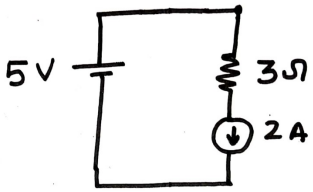
(a)



(b)



(c)



(d)

In Next Lecture

- Answer of tutorial seat Problem
- Concepts of dependents source
- A seat of numerical examples

Thank you