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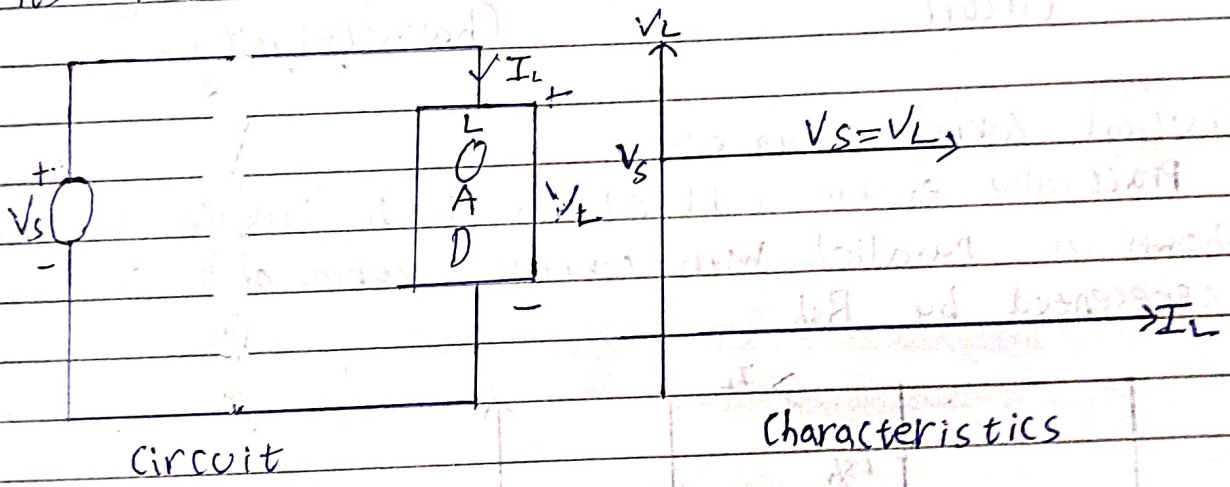
BEE Assignment - 2

Q1] Explain Ideal & practical voltage sources & ideal & practical current sources.

→

1] Ideal Voltage source :-

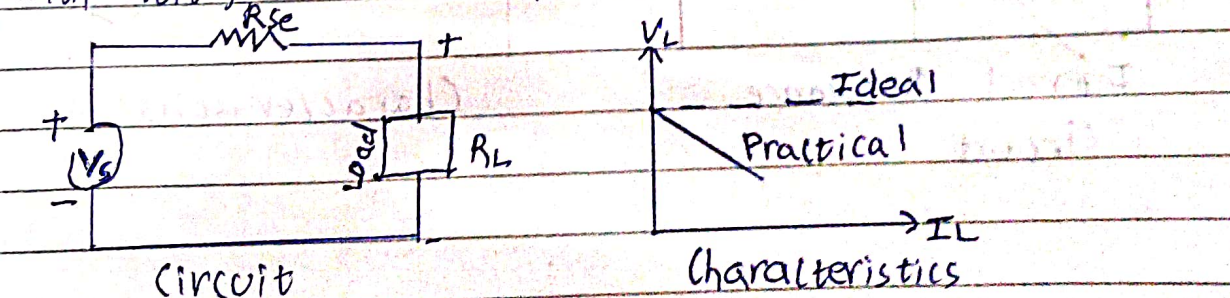
→ An Ideal Voltage source is one which gives constant voltage across its terminal irrespective of current drawn symbol for ideal voltage source and its V-I characteristics are shown in fig.



Circuit Characteristics

2] Practical Voltage source

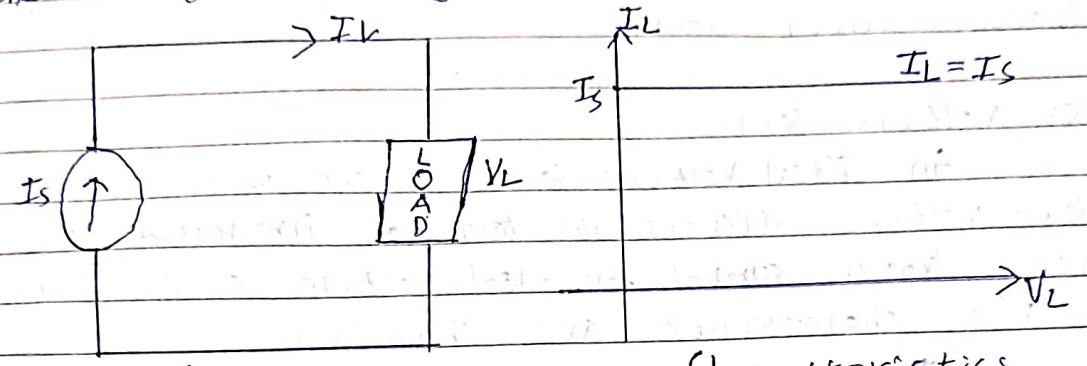
Every Voltage source has small internal resistance shown in series with voltage and is represented by Rse as shown in fig



Circuit Characteristics

3] Ideal current source:-

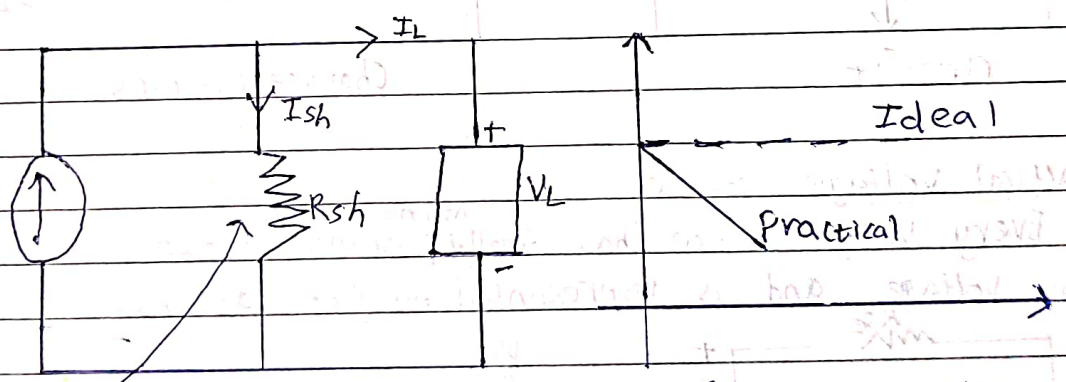
Ideal current source is the source which gives constant current at its terminal irrespective of the voltage appearing across its terminal.



Circuit Characteristics

4] Practical current source:-

Practically every current has high internal resistance, shown in parallel with current source and its represented by Rsh



Internal Resistance Circuit Characteristics

Q2] State & Explain superposition theorem.

- Statement :-

Superposition therom states that in any linear bilateral Network containing two or more sources, the current in any element is equal to algebraic sum of current caused by indivisual source acting alone, while other sources are inoperative.

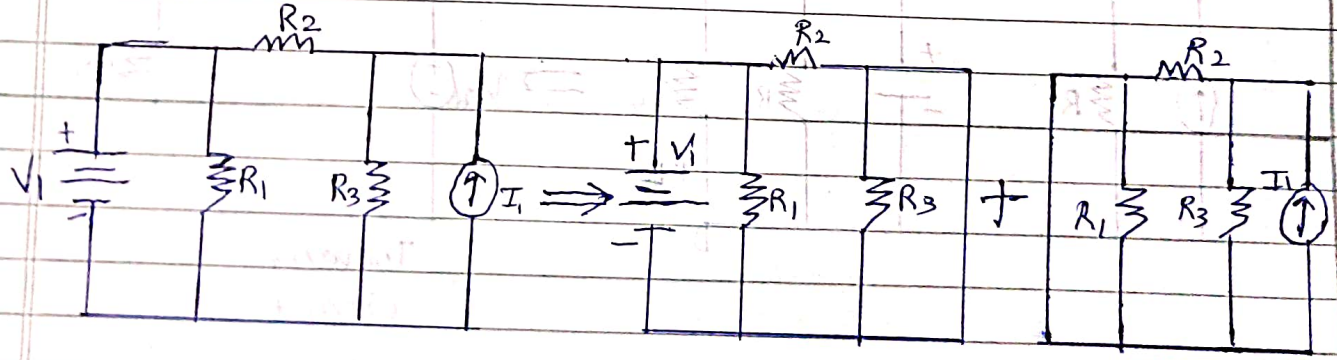
- Steps to apply superposition therom:-

Step 1:- Select a single source acting and short the other vatage souries and open the current sources.

Step 2:- Find the current through or the voltage accross the required elements to the sourie under consideration using a suitable network simplification technique.

Step 3:- Repeat the above two steps for all the sources

Step 4:- Add the indivisual effects produced by indivisual sources to obtain the total current in or voltage accross the element.



Q37] State and explain thevenins therom

- Statement :-

It states that any linear circuit containing several voltage sources and resistors can be simplified to a thevenins equivalent circuit with single voltage source and resistance connected in series with load.

- Steps to apply thevenins therom:-

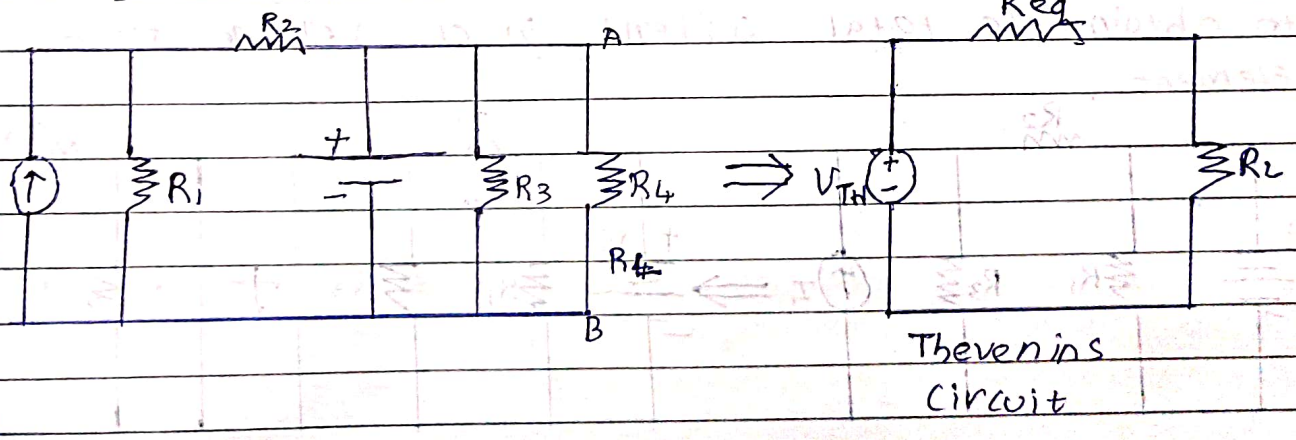
Step 1:- Remove the branch the current through which to be obtained.

Step 2:- Calculate the open circuit voltage V_{TH}

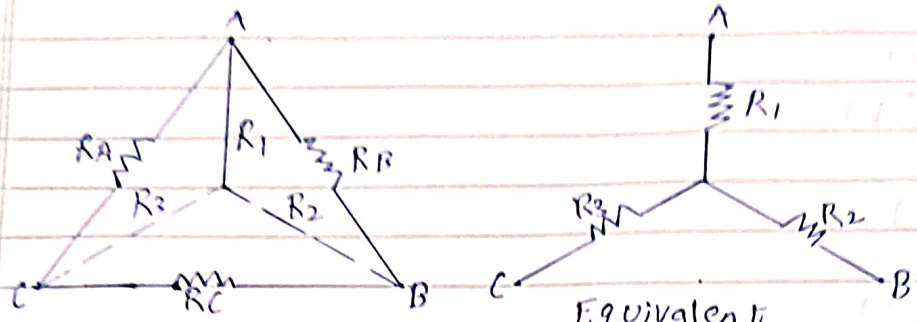
Step 3:- Obtain Req between open circuit

Step 4:- Draw thevenin equivalent circuit and connects the removed branch to find branch current

$$I_L = \frac{V_{TH}}{Req + R_L}$$



Q] Derive the expression for delta to star conversion



Given delta

Equivalent Star

Consider 3 resistances R_A, R_B, R_C connected in Delta shown in figure

$$R_1 = \frac{R_A R_B}{R_A+R_B+R_C}, \quad R_2 = \frac{R_B R_C}{R_A+R_B+R_C}, \quad R_3 = \frac{R_A R_C}{R_A+R_B+R_C}$$

Consider A B

$R_B \| (R_A+R_C)$

$$\frac{R_B(R_A+R_C)}{R_A+R_B+R_C} \quad \text{---} \quad (1)$$

Consider B C

$R_C \| (R_B+R_A)$

$$\frac{R_C(R_A+R_B)}{R_A+R_B+R_C} - (2)$$

Consider C A

$$\frac{R_A(R_B+R_C)}{R_A+R_B+R_C} \quad -(3)$$

from figure (b)

Consider A ↔ B

$R_1 + R_2$ — (iv)

Consider B ↔ C

$R_2 + R_3$ — (v)

Consider A ↔ C

$R_1 + R_3$ — (vi)

$$R_1 + R_2 = \frac{R_B(R_A + R_C)}{R_A + R_B + R_C} \quad - (vii)$$

$$R_2 + R_3 = \frac{R_C(R_A + R_B)}{R_A + R_B + R_C} \quad - (viii)$$

$$R_1 + R_3 = \frac{R_A(R_B + R_C)}{R_A + R_B + R_C} \quad - (ix)$$

Substract (vii) − (viii)

$$R_1 - R_3 = \frac{R_B(R_A + R_C) - R_C(R_A + R_B)}{R_A + R_B + R_C} \quad - (x)$$

Add (ix) & (x)

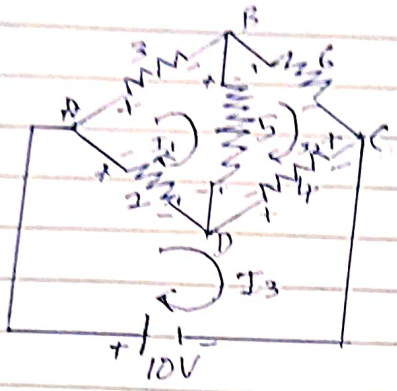
$$2R_1 = \frac{R_A R_B + R_A R_C + R_B R_C + R_B R_A - R_C R_A - R_B R_C}{R_A + R_B + R_C}$$

$$\boxed{R_1 = \frac{R_A R_B}{R_A + R_B + R_C}}$$

Similarly

$$\boxed{R_2 = \frac{R_B R_C}{R_A + R_B + R_C}} \quad , \quad \boxed{R_3 = \frac{R_A R_C}{R_A + R_B + R_C}}$$

Q5] Using Kirchoffs law calculate current flowing through R_{BC}



For Loop 1

$-3I_1 - 5(I_1 - I_2) - 2(I_1 - I_3) = 0$

$-3I_1 - 5I_1 + 5I_2 - 2I_1 + 2I_3 = 0$

$-10I_1 + 5I_2 + 2I_3 = 0 \quad -(1)$

For loop 2

$-6I_2 - 4(I_2 - I_3) - 5(I_2 - I_1) = 0$

$-6I_2 - 4I_2 + 4I_3 - 5I_2 + 5I_1 = 0$

$5I_1 - 15I_2 + 4I_3 = 0 \quad -(2)$

For loop 3

$-2(I_3 - I_1) - 4(I_3 - I_2) + 10 = 0$

$-2I_3 + 2I_1 - 4I_3 + 4I_2 + 10 = 0$

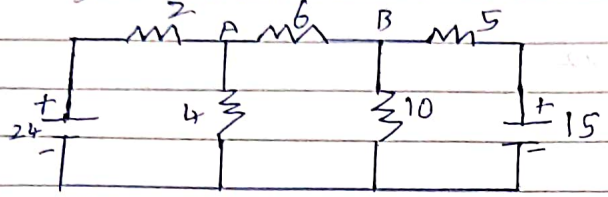
$2I_1 + 4I_2 - 6I_3 = -10 \quad -(3)$

From eqn (1), (2) & (3)

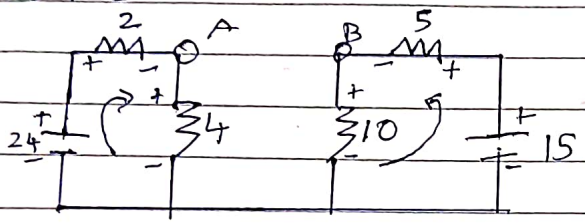
$I_1 = 1.11$, $I_2 = 1.11$, $I_3 = 2.77$

∴ Current flowing though $R_{BC} = I_2 = \underline{1.11}$

Q] Using thevenins theorm determine valve of current flowing through 6Ω resistance



Step 1



Step 2 :-

$-2I_1 - 4I_1 + 24 = 0$; $-5I_2 - 10I_2 + 15 = 0$

$-6I_1 + 24 = 0$ $\quad -15I_2 + 15 = 0$

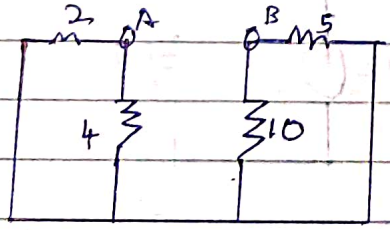
$24 = 6I_1$ $\quad 15 = 15I_2$

$I_1 = 4$ $\quad I_2 = 1$

Traling path for V_{TH}

$V_{TH} = 16 - 10 = 6$

Step 3 :- Req.

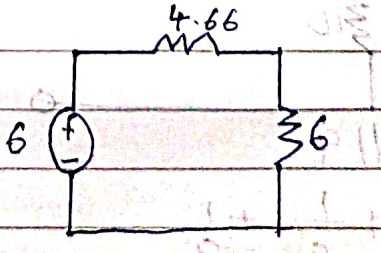


$4 \| 2 + 5 \| 10$

$\frac{4 \times 2}{4+2} + \frac{5 \times 10}{5+10}$

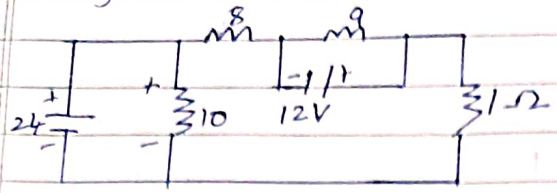
$= 1.33 + 3.33 \Rightarrow 4.66$

step 4 : thevenins circuit

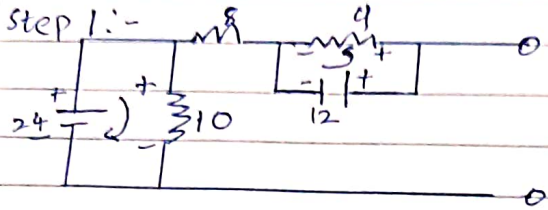


$$I = \frac{6}{4.66+6} = 0.56$$

Q8] Using Thevenins theorem calculate current in 1-Ω resistance



Step 1:-



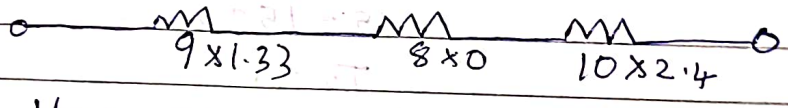
Step 2:-

$-10I_1 + 24 = 0$; $-9I_2 + 12 = 0$

$24 = 10I_1$; $12 = 9I_2$

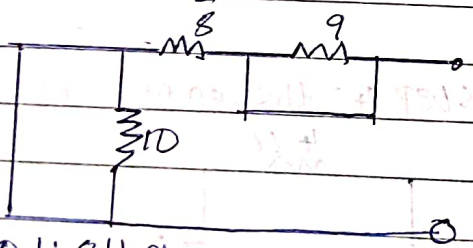
$I_1 = 2.4$; $I_2 = 1.33$

Tracing path for V_{TH}



$V_{TH} = 24 - 12 = 12.$

Step 3:- Req

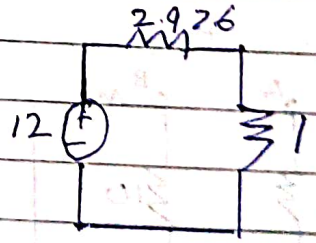


$10 || 8 || 9$

$\frac{1}{R_{eq}} = \frac{1}{10} + \frac{1}{8} + \frac{1}{9}$

$\frac{1}{R_{eq}} = 0.336 \Rightarrow R_{eq} = 2.976$

Step 4:- thevenins Circuit



$\Rightarrow$

$I_L = \frac{12}{3.976} = 3.018$