Name : Tanjim Reza

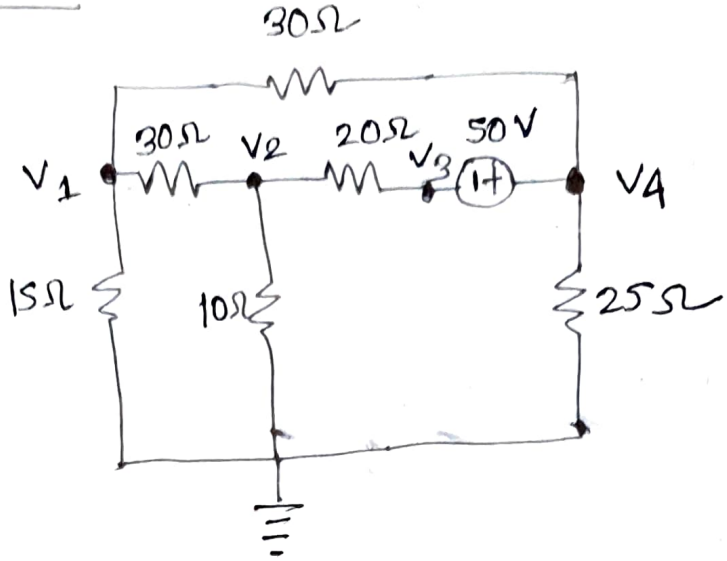
Student ID : 20101065

Course : CSE250

Section : CSE06

Assignment : 02

Problem 01:



Node Equation for Node 01:

$$V_1\left(\frac{1}{15}+\frac{1}{30}+\frac{1}{30}\right)-\frac{V_2}{30}-\frac{V_4}{30}=0 \qquad \left[\frac{V_0}{1s}=0\right]$$

Node 02:

$$V_2\left(\frac{1}{30}+\frac{1}{10}+\frac{1}{20}\right)-\frac{V_1}{30}-\frac{V_3}{30}=0$$

.50V source:

(Positive - Negative)

$$\therefore \quad V_4 - V_3 = 50$$

Node 3, 4 (supernode)

$$V_4\left(\frac{1}{25}+\frac{1}{30}\right)-\frac{V_1}{30}+\frac{V_3}{20}-\frac{V_2}{20}=0$$

Power for voltage source (50 V)

$$P = V I$$

$$= (V_4 - V_3)\left(\frac{V_3 - V_2}{20}\right)$$ (Already comidered for sign)

Solving Node Equations with calculator

$V_1 = 2.24252\ V$

$V_2 = -8.47176\ V$

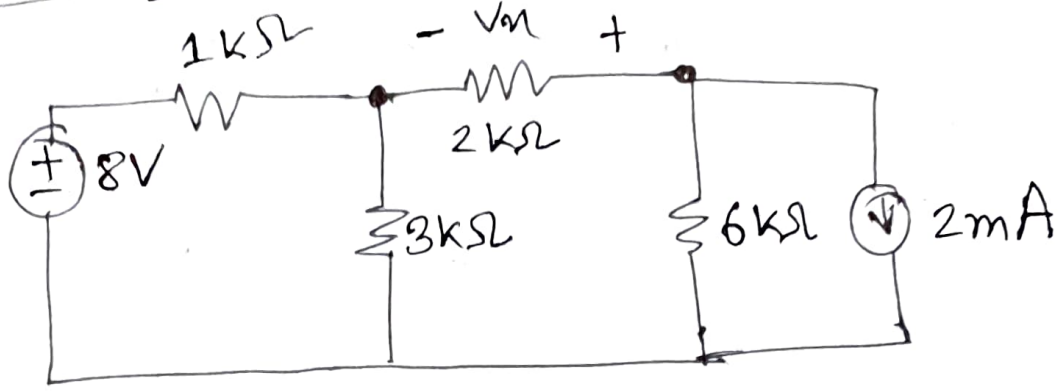
$V_3 = -32.5581\ V$

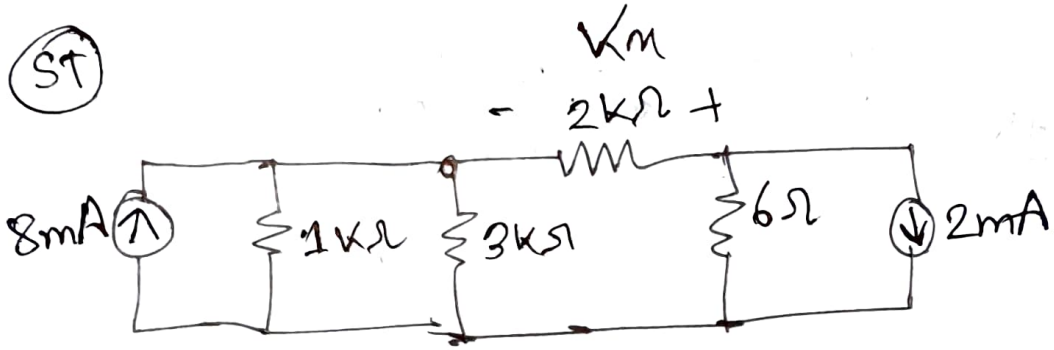
$V_4 = 17.4419\ V$

$\therefore P = -60.21585$ watt (took all values from calculator)

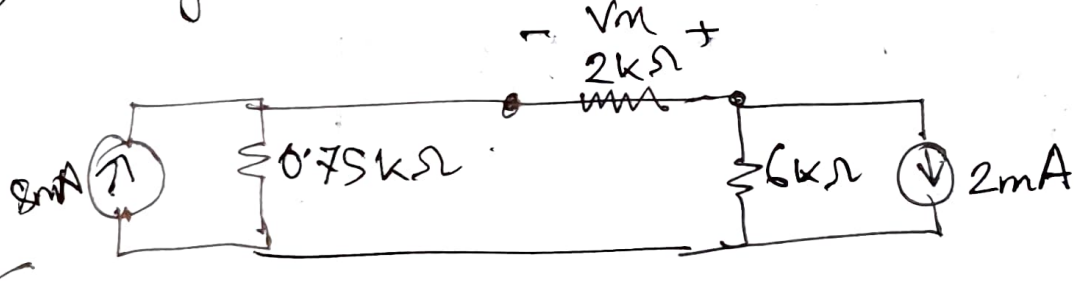
Negative means supplying.

Problem 02:

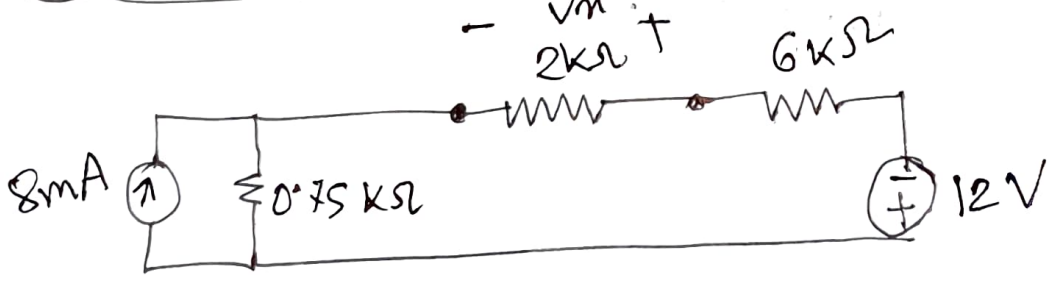




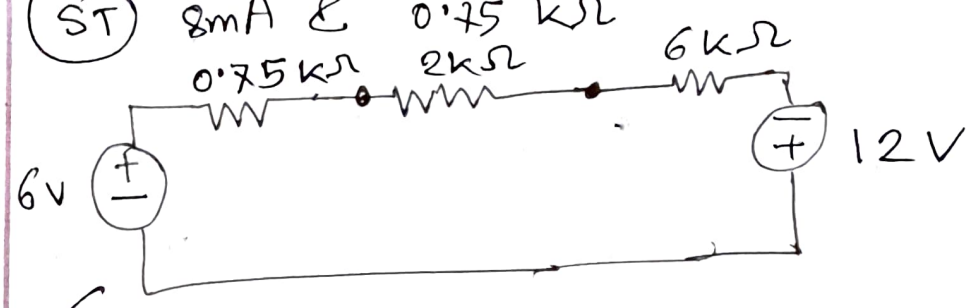
Taking 1kΩ & 3kΩ



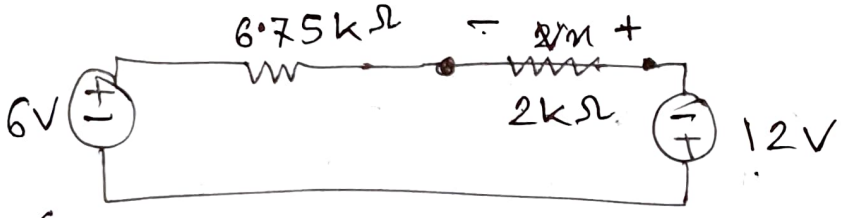
ST 6kΩ & 2mA



(ST) 8mA & 0·75 kΩ



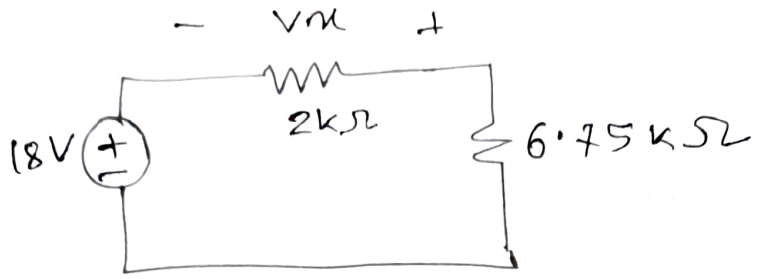
↳ 0·75kΩ & 6kΩ



↳ 6V & 12V

$\therefore V_1 = 18V$

$R_1 = 6·7\,\Omega$



$\therefore$ $V_1 = 18\,V$

$R_1 = 6{\cdot}75k\Omega$

$\therefore V_x = \frac{2}{6{\cdot}75+2} \times 18$

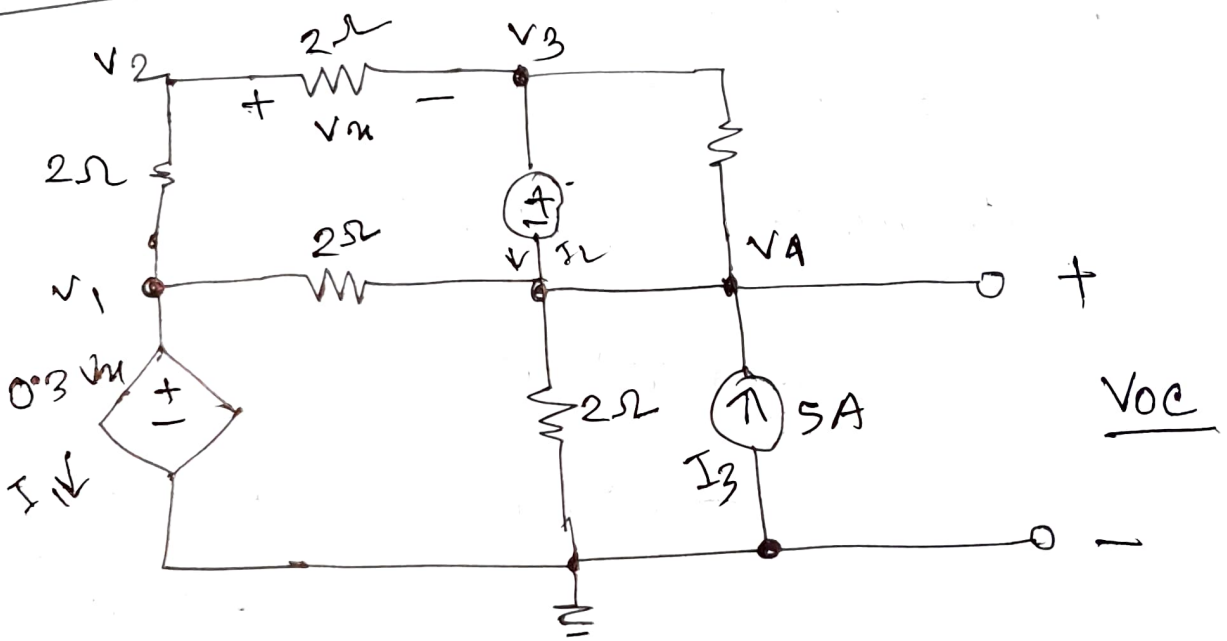
$= +4{\cdot}114285$

$= -4{\cdot}114285$ (because of the $-V_x+$)

Problem 03:

For Thevenin we have to make open circuit then short circuit

Open circuit:



Equation for Node 01:

$$V_1 = 0.3\,V_x$$

$$\Rightarrow V_1 - 0 = 0.3\,V_x$$

$$\Rightarrow V_1 - 0.3\,V_x = 0$$

$$\Rightarrow V_1 - 0.3(V_2 - V_3) = 0$$

[From the circuit image]

For Node 02:

$$V_2\left(\frac{1}{2}+\frac{1}{2}\right)-\frac{V_1}{2}-\frac{V_3}{2}=0$$

Node 03:

$$V_3\left(\frac{1}{2}+\frac{1}{2}\right)-\frac{V_2}{2}-\frac{V_4}{2}+I_2=0$$

Node 4:

5A

$$V_4\left(\frac{1}{2}+\frac{1}{2}+\frac{1}{2}\right)-\frac{V_1}{2}-\frac{V_3}{2}-\frac{0}{2}-I_3-I_2=0$$

$$\Rightarrow V_4\left(\frac{1}{2}+\frac{1}{2}+\frac{1}{2}\right)-\frac{V_1}{2}-\frac{V_3}{2}-5-I_2=0$$

Supernode V_3, V_4 (could just ignore that I here)

$$V_4\left(\frac{1}{2}+\frac{1}{2}+\frac{1}{2}\right)-\frac{V_1}{2}-\frac{V_3}{2}-5-I_2+V_3\left(\frac{1}{2}+\frac{1}{2}\right)-\frac{V_2}{2}$$

$$-\frac{V_4}{2}+I_2=0$$

Equation for 4V source

$$V_3-V_4=4V$$

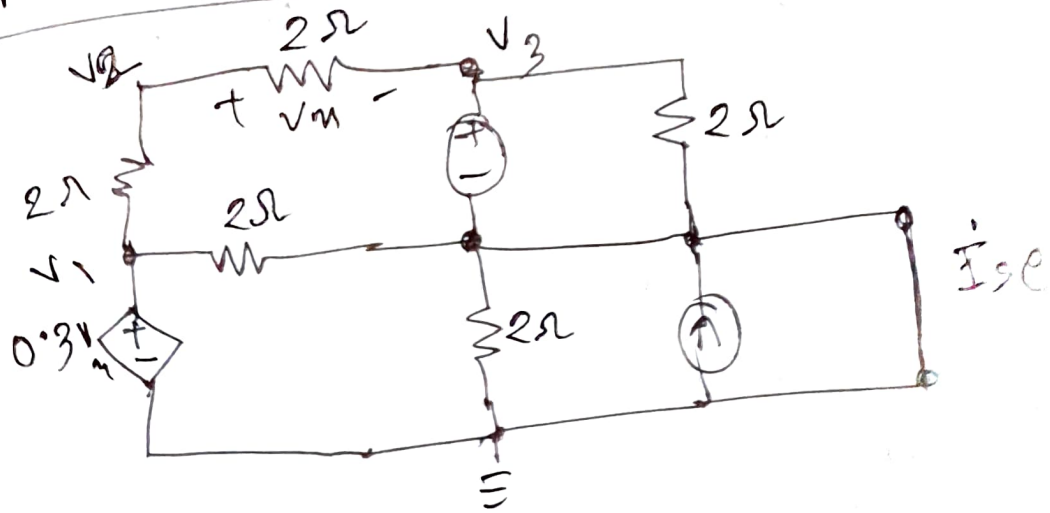
Solving, V_1, V_2, V_{34} Supernod, $V_3 - V_4$ with calculator

$$V_1 = -1.14894$$
$$V_2 = 2.68085$$
$$V_3 = 6.51064$$
$$V_4 = 2.51064$$

We know, our V_{oc} is V_4 here and the V_o ground

$$\therefore V_4 = V_{oc} = V_{th} = 2.51064$$

Now for short circuit:



Here whole $V_4 = V_0$

∴ Node 01

$$V_1 - 0.3(V_2 - V_3) = 0 \quad \text{(from before)}$$

Node 02:

$$V_2\left(\frac{1}{2} + \frac{1}{2}\right) - \frac{V_1}{2} - \frac{V_3}{2} = 0$$

Node 03:

$$V_3 - V_4/V_0 = 4$$

$$\Rightarrow V_3 - 0 = 4$$

$$\Rightarrow V_3 = 4$$

Solving with calculator

$V_1 = -0.705882$

$V_2 = 1.64706$

$V_3 = 4.0$

$$\therefore I_1 = \frac{0-(-0.705882)}{2} = 0.352941$$

$$I_2 = 5A$$

$$I_3 = \frac{-4}{2} = -2$$

$$\therefore I_{sc} = I_1 + I_2 + I_3$$

$$= 0.352941 + 5 - 2$$

$$= 3.352941$$

$$\therefore R_{th} = \frac{V_{th}}{I_{sc}} \qquad [V_{th} = 2.51064)$$

$$= \frac{2.51064}{3.352941}$$

$$= 0.748787$$